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	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Dea
and Bay Islands -	1,238	1,321	86	13·7
d - - -	2,649	1,487	102	7·93
Orissa - - -	2,274	1,536	97	21·55
lain and Chutia-Nagpur	7,068	1,440	105	16·98
-Himalayan -	14,675	1,533	94	14·31
ley and North-Western Raj- - - -	4,892	1,892	88	21·67
stern Rajputana, Central India, ujarat - - -	6,348	1,636	105	13·86
- - -	9,706	1,347	97	12·05
Coast - - -	1,562	1,149	83	10·24
India - . - -	3,781	1,015	72	6·08
s - - - -	8,959	1,358	91	10·83
escent Depôts - -	2,049	1,599	105	12·69

bove 12 groups, just a half returned a higher daily sick-rate than the ratio ble European Army, the highest being 105 per 1,000 of average strength in ic Plain and Chutia-Nagpur, South-Eastern Rajputana, &c., and Hill t Depôts groups. The Burma Inland group followed with a ratio of 102 and nd Orissa and Deccan groups came next with ratios of 97 per 1,000 each. est ratio (72) was returned by the Southern India group. The death-rate of the rmy was exceeded by three groups, viz., the Indus Valley and North-Western na, Bengal and Orissa and Gangetic Plain and Chutia-Nagpur groups.
e stations with a strength of over 1,000, four returned death-rates above 20 per iz., Peshawar 32·99, Lucknow 21·51, Chakrata 20·59, and Aden 20·23.

ortality from cholera in the European Army was very low. The admissions tal from the disease numbered only 44 or 0·6 per 1,000 of average strength, 209 or 2·9 per 1,000 in 1894, and the deaths fell from 149 or 2·10 per 1,000, 0·45.

g the whole of the European troops in India there were during the year under ly 19 cases of small-pox; of these two were fatal, one each in the Bengal ras Commands. In the previous year there were 13 cases and three deaths.

intermittent fever the admissions to hospital among the European troops in re in the ratio of 336 per 1,000 of strength against 412 in the previous year hs under this head numbered 18, an increase of 5 on the mortality of 1894. 8 occurred among troops in the Punjab Command and 5 among those in the Command.
enteric fever the admissions rose from 1,484 or 20·9 per 1,000 of strength, to 26·3, and the deaths from 409 or 5·75 per 1,000 to 477 or 6·72. Of the four ds Punjab recorded the highest mortality under this head, viz., 10·29, by Bengal with a ratio of 7·59, Bombay 4·48, and Madras 2·61. Among the ations with an average strength of over 1,000, Peshawur returned a death- this fever of 16·80, Chakrata 15·69, Lucknow 15·36, Agra 14·75, Meerut in two other stations (Umballa and Rawalpindi) the ratios exceeded that for army. As usual, young and unacclimatised soldiers were the chief sufferers; ose under 25 years of age the death-rate was 8·22 per 1,000 against 8·51 in ile among men between 25 and 29, and from 30 to 34, the mortality was 2·89 per 1,000 respectively. Among men of less than one year's residence in death-rate from this fever was 10·83 per 1,000, among men between one years 3·30, and among troops between five and ten years' service the rate per 1,000.

nissions from dysentery and diarrhœa among the European troops were in f 69 per 1,000 of strength or 12 per 1,000 more than in 1894. The mortality ntery was in the ratio of 1·04, and from diarrhœa 0·07 per 1,000. Dysentery ea were most prevalent in the Punjab Command.

REPORT.

The present Report on Sanitary Measures in India during the year 1895 is prep for presentation to Parliament. It contains chapters on the health of the Euro and Native troops, on the health of prisoners in jails, and on the health of the gen population; it also contains chapters on vaccination, on medical institutions, inclu medical schools and lunatic asylums, and a chapter on sanitary works. Ap to the Report are abstracts of reports by the three principal Sanitary Commis in India, and memoranda by the Army Sanitary Commission in England re the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

The health of the European troops on service in India during 1895 wa better than in the previous year. On an average strength of 71,031, the admi into hospital were in the ratio of 1,462 per 1,000 against 1,508 in 1894, the sick-rate was 94 or 2 per 1,000 more, and the death-rate fell from 16·07 to 15·26. invaliding ratio (23) was also lower by 2 per 1,000, so that the total loss by deat invaliding was equal to 39 per 1,000, a decrease of 3 per 1,000 on the previous

The Presidential Army system was abolished in 1894, and all the forces in are now designated the Army of India, divided into the Bengal, Punjab, M and Bombay Commands. This organization took effect from the 1st April 1895

The following statement shows the relative extent of sickness and mortality European troops in the four Commands during 1895 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	T
Bengal (including the Punjab in 1894)	1895	22,259	1,436	98	16·98	26	
	1894	44,267	1,567	94	18·55	24	
Punjab	1895	19,733	1,519	92	20·02	18	
Madras	1895	13,417	1,227	91	8·79	31	
	1894	13,397	1,273	89	9·48	29	
Bombay	1895	15,622	1,627	92	12·35	21	
	1894	13,418	1,549	85	14·46	27	
INDIA	1895	71,031	1,462	94	15·26	23	
	1894	71,082	1,508	92	16·07	25	

It will be seen from the above statement that of the four Commands Beng highest daily sick-rate and the Punjab the highest death-rate. The Madras C was the healthiest, and its death-rate was less than half that of the Punjab.

The chief causes of sickness in the whole European Army were, as in the y venereal diseases and ague, the former yielding a ratio of 522 per 1,000 ag in 1894, and the later 336 per 1,000 against 412. More than half (59 per the total sickness resulted from these two causes. Enteric fever, as usual chief cause of mortality, and the death-rate from it was 6·72 per 1,000 ag in 1894. This fever caused 44 per cent. of the total deaths.

Venereal diseases as usual came first in the list of causes of admission to hospital; and also in the causes of invaliding. They were the cause of 36 per cent. of the total sickness during 1895, and nearly 20 per cent. of the invaliding of the European Army of India. The ratio of admissions from venereal diseases per 1,000 of strength was 522 or 11 above that of 1894. This is vastly in excess of the ratio of most continental armies, and also of the ratios of British troops in other parts of the world. The admission-rate under this head was highest in the Bengal Command, viz., 605 per 1,000, next came Madras with a ratio of 531, Bombay with 527, and the Punjab 419. Dr. Cleghorn, Sanitary Commissioner with the Government of India, in his report for the year under notice, gives figures "showing clearly how the "arrival year by year of fresh batches of young unmarried men under the short "service system has been accompanied by an increase of venereal disease. Since 1878 "the number of fresh troops arriving in the country has, as a rule, been much greater "than before. The gradual rise in the percentage of men under 25 years of age in "the army, and of men under five years' Indian service has been pretty uniform, as "has been the well-marked decline in the number of married men; and the same "may be said of the gradual rise in the venereal ratio. As youth and recent arrivals "have become more common in the army, venereal disease and enteric fever have not "unnaturally increased in frequency of occurrence." . . . . Statistics also "show a more or less continuous rise in the incidence of venereal disease, more "especially since 1885; and the increase in the ratio of secondary syphilis is of grave "importance, more particularly with regard to the individual. No man who has not "been effectually cured of syphilis can be reckoned upon as an efficient soldier; and "the mischief is not confined to the individual, as the physical weaknesses are "continued to succeeding generations." The Army Sanitary Commission remark "that the great and increasing prevalence of this class of disease in India is most "lamentable, and we are glad to learn that an earnest attempt is being made on the "part of the Indian Government to devise some measures for dealing with it. The "evil has reached dimensions which threaten to be ruinous to the efficiency of the "European Army in India, to say nothing of its far-reaching and dreadful effects on "a number of innocent persons in this country."

The loss to the whole army by invaliding during 1895 amounted to 1,663 men, equal to 23·4 per 1,000, against 1,808 or 25·4 in 1894. The proportion of invalids to strength was highest in the Madras Command (31·2), followed by Bengal (25·5), Bombay (20·7), and Punjab (17·9). Of the total number invalided, 33 per cent. were discharged as unfit for further service, being 6 per 1,000 lower than in 1894. As regards the influence of age and length of residence in India upon invaliding, 66 per cent. of the total number invalided were under 25 years of age, against 60 in 1894, while 36 per cent. were of less than two years' service, and 86 per cent. were of less than five years' service. In the European Army as a whole 83 per cent. of the total strength had seen less than five years' service.

II.—NATIVE ARMY.

There was less sickness in the Native Army of India during 1895 than in the previous year, but the mortality was slightly higher, which was due to the greater prevalence of pneumonia, as from all the other chief diseases there was a decrease in the death-rates.

The ratios of sickness and mortality among Native troops in the six Commands during 1895 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal (including the Punjab in 1894)	1895	24,454	790	30	8·26
	1894	65,446	934	33	12·01
Punjab	1895	41,062	878	33	17·58
Madras	1895	26,738	660	30	8·38
	1894	26,628	678	30	9·84
Bombay	1895	25,259	889	28	11·12
	1894	23,757	1,168	34	10·73
Corps of Central India and Rajputana	1895	5,172	595	21	6·77
	1894	5,089	683	20	7·07
Hyderabad Contingent	1895	6,968	617	22	5·74
	1894	6,924	620	21	5·34
India	1895	129,655	794	30	11·60
	1894	127,844	897	31	10·76

Of the six Commands the Punjab was the most unhealthy, due to service in the Waziristan and Chitral expeditions. Pneumonia was very prevalent in this force, and the death-rate from it was 8·33 per 1,000 or nearly half of the total mortality.

The chief cause of sickness in the Native Army was ague, which caused 36 per cent. of the total admissions against 42 per cent. in the year 1894. Among the diseases from which the admissions to hospital were higher than in 1894 were pneumonia, tubercle of the lungs, dysentery, diarrhœa, and scurvy; while from cholera, ague, simple continual fever, respiratory diseases other than pneumonia, and venereal diseases, there was a decrease in the admissions. From venereal diseases the admission-rate in the Native Army was only 31·3 per 1,000 of strength as compared with 522 per 1,000 among European troops. Figures under this head are not available for the years before 1877. The ratios run at a much lower level than those of European troops, and there is not the same tendency to increase. Only once since 1877 has the rate reached 40 per 1,000, that was in 1890 when the admission-rate was 41·1.

Respiratory diseases were the chief causes of death in the Native Army, and no less than 42 per cent. of the total deaths were due to them. The death-rate under this head was 4·87 per 1,000 of average strength, against 4·20 in 1894. From pneumonia the mortality among the Native soldiers (4·20 per 1,000) was about eight times as great as that among European troops (0·51 per 1,000). Fevers of all kinds were the cause of 16 per cent. of the total deaths, against 48 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 1·81 per 1,000, while among the European troops the proportion was 0·59. On the other hand, the death-rate from enteric fever among Native troops was only 0·07 per 1,000 as compared with 6·72 among the European troops. From cholera there were only 53 deaths in the Native Army, equal to 0·41 per 1,000 of strength, as compared with 71 and 0·56 respectively in 1894.

The following statement gives the principal statistics of the Native Army in geographical groups for 1895 :—

	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Dea
Burma Coast and Bay Islands -	2,145	545	24	12·
Burma, Inland - - -	6,680	978	43	10·
Assam - - - -	2,259	1,037	39	14·
Bengal and Orissa - - -	3,047	982	37	5·
Gangetic Plain and Chutia-Nagpur -	6,493	598	23	7·2
Upper Sub-Himalayan - -	12,613	738	30	11·6
Indus Valley and North-Western Rajputana - - - -	14,749	994	35	18·71
South-Eastern Rajputana, Central India, and Gujarat - - -	13,052	715	24	7·59
Deccan - - - -	20,686	764	27	6·62
Western Coast - - -	3,096	653	30	9·69
Southern India - - -	9,092	574	26	6·93
Hill Stations - - -	15,081	971	37	13·53

In five of the above groups the daily sick and death-rates were higher th those for the whole Native Army. The highest mortality was that of the Ind Valley and North-Western Rajputana group (18·71), which shows an increase 4·87 per 1,000 on the rate for the previous year.

Of the stations with a strength of over 1,000, the following recorded death-ra exceeding 20 per 1,000 of strength :—Edwardesabad (36·06), Dera Ghazi Khan (23·1 Kohat (22·67), Dharmsala (20·97), and Dehra Dun (20·78).

III.—GENERAL POPULATION.

s were registered throughout all the 10 provinces of India in 1895, and the tes varied between 43·91 and 26·39 per 1,000 of population under registration. st results were obtained in the Punjab, Berar, Bombay, the North-Western ces and Oudh, Bengal and the Central Provinces, their respective rates being 7·2, 35·8, 34·9, 34·6, and 33·4. In the remaining provinces the birth-rates between 31·0 in Assam and 26·39 in Coorg. In five provinces the birth-rates igher than in the previous year, and in four they were lower. The birth- xceeded the death-rates in seven provinces, the excess per 1,000 varying between n the Punjab and 3·20 in Bengal. The year 1895 was more healthy than the ding year, and the recorded deaths fell from 7,241,323 or 33·08 per 1,000 of tered population in 1894, to 6,163,743 or 28·94. With the exception of Assam, r, and Coorg, the number of deaths recorded in the several provinces was lower in 1894. Of the chief diseases, cholera was much less prevalent, and the total ber of deaths from it fell from 521,647 to 310,797. The decrease was spread over of the provinces, the others showed a material increase. There was a considerable rease also in the deaths from fevers, which was participated in by all the provinces pt Assam, Madras, and Coorg. In connexion with this cause of death the scheme the sale of quinine at a low price by postal agency was making steady progress. he mortality from dysentery and diarrhœa was also lower than in the previous year; t from small-pox there was an increase of 2,719 deaths.

The deaths from the chief diseases and from all causes in the several provinces were follow :—

	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1895.	1894.
ngal	177,087	2·49	13,020	0·18	1,634,254	22·99	49,871	0·70	2,231,458	31·39	34·88
rth-Western Provinces and Oudh	51,562	1·10	1,968	0·04	1,093,212	23·31	42,778	0·91	1,366,443	29·13	42·51
njab	549	—	8,334	0·41	392,118	19·08	15,648	0·76	601,972	29·29	36·52
ower Burma	5,150	1·14	1,540	0·34	48,049	10·64	8,794	1·95	101,160	22·40	23·56
ntral Provinces	15,506	1·63	6,644	0·70	221,418	23·30	20,316	2·14	349,137	36·75	37·22
Co s	—	—	7	0·04	4,064	23·48	367	2·12	5,073	29·31	24·59
Assa n	18,962	3·78	3,849	0·77	92,359	18·39	15,523	3·09	169,304	33·72	30·69
Madra s	21,172	0·6	5,111	0·1	277,337	8·3	23,937	0·7	658,719	19·6	20·0
Bombay	8,890	0·47	2,299	0·12	388,848	20·66	35,348	1·88	538,540	28·61	32·26
Berar	11,919	4·2	556	0·2	66,203	23·2	24,452	8·6	141,937	49·9	42·0
Total	310,797	1·45	43,328	0·20	4,217,862	19·80	237,034	1·16	6,163,743	28·94	33·08

The public health in Bengal during 1895 was generally better than in the previous year, which was one of the most unhealthy known. The birth-rate was higher, though still considerably below the ratio estimated by actuaries. The number of births registered in the province rose from 2,332,247 or 32·81 per 1,000 of population in 1894 to 2,458,623 or 34·59 per 1,000, the latter being made up of district rates varying from 46·61 in Noakhali and 45·92 in Backergunge to 25·73 in 24 Parganas. Of the 46 districts there was an increase of births in 33, the greatest advance being in Noakhali, where the ratio was 8·93 per 1,000 in excess of the previous year. Manbhum came next with an increase of 7·02, followed by Tippera with an increase of 6·90, and then Midnapore, Mymensingh, and Rajshahi, each with an improvement of over 5 per 1,000. In rural areas the birth-rate was 35·13 per 1,000, and in towns 23·91, as compared with 33·32 and 22·71 respectively in 1894. Out of 147 towns only four returned a birth-rate in excess of 40 per 1,000, while 42 rural areas returned rates of 45 per 1,000 and over.

The total number of deaths registered during the year under notice was 2,231,458, or 31·39 per 1,000 as compared with 2,479,096 or 34·88 in 1894. There was thus an excess of births over deaths of 227,165 or 3·20 per 1,000. The district death-rates ranged from 41·48 in Jessore to 19·62 in Singhbum. In urban areas the rate of

Mortality declined from 35·34 to 34·40, which was made up of ratios varying from 9·44 in the small municipality of Bhadreswar in Hooghly to 12·68 in Jhalakati in Backergunje. Sixteen out of the 147 towns returned a death-rate in excess of 44·8 per 1,000, the estimated normal rate of the province, while 27 returned rates below 25 per 1,000. "In these places" the Sanitary Commissioner (Dr. Dyson) states, "registration seems to be very carelessly carried out. In the towns which returned a "death-rate in excess of the estimated normal the mortality in no less than 11 was in "excess of the previous year. For this cholera in some places and fever in others were "principally responsible." In rural areas the death-rate fell from 34·85 to 31·24, the highest mortality for such areas being recorded in the districts of Jessore (41·52), Nadia (38·85), Darjeeling (38·41), Pabna (37·78), Rajshahi (37·71), Hooghly (37·15), Jalpaiguri (36·08), Dinajpur (35·95), and Faridpur (35·27), but in all of these the figures are considerably below the estimated normal death-rate.

Of the chief death causes cholera was less prevalent in 1895 than in the previous year, the number of deaths registered from it being 177,087 or 2·49 per 1,000 against 236,150 or 3·32 in 1894. Every district was affected by the disease, but the mortality varied greatly, and the number of villages attacked was 24,103 or 10·72 per cent. of the total, against 30,223 or 13·44 per cent. in 1894. Four districts recorded cholera death-rates of over 5 per 1,000, viz., Dacca (7·08), Faridpur (6·03), Nadia (5·36), and Jessore (5·35), and in ten districts the rates were below 1 per 1,000. Nearly all the districts which had the highest cholera mortality in 1894 showed comparatively low rates in 1895. As regards the seasonal incidence of the disease in each of the main geographical divisions of the province, the seasons of highest mortality in Bengal proper were December, April, November, May and March. In Behar the rates were highest in August, June, July, September, and May; in Orissa in November, October, July, September, and August and December equal; in Chota Nagpur in April, May, August, and June. "There can be little doubt," the Sanitary Commissioner says, "that the character of the soil plays an important part in the seasonal "incidence of cholera." Since the close of 1895, Dr. Haffkine, with a special staff, has been engaged under the Bengal Sanitation Department, in cholera inoculation. A large number of people were inoculated in the areas in which cholera has lately been prevailing in epidemic form, especially Serampore, but a complete statement of the results has not yet been furnished, owing to Dr. Haffkine's absence in Bombay on an inquiry into the nature of the plague.

From small-pox the mortality was higher than in 1894, the number of deaths having risen from 8,404 or 0·11 per 1,000 to 13,020 or 0·18 in 1895, an insignificant rate, however, when compared with those from other diseases prevalent in Bengal. The disease was present in all the districts except Singhbhum, but excluding Calcutta, where there was a severe epidemic, the death-rate reaching 3·25, in no other district did the ratio reach 1 per 1,000. Faridpur district returned the next highest rate (0·72). This district is notorious for its opposition to vaccination, headed by the influential sect of Ferazi Muhammadans. At the close of the year steps were taken to overcome the opposition with satisfactory results, the Ferazi High Priest, Maulvi Syuddin, and through his influence all the most important leaders of religious and other communities almost throughout Eastern Bengal, being now believers in vaccination.

No less than 73 per cent. of the total deaths were recorded under fever, a term which, Dr. Dyson observes, is loosely construed by the illiterate agency responsible for reporting deaths, so that pneumonia, phthisis, and other diseases attended with a rise of temperature, and practically nearly all diseases except small-pox and cholera, are included under this heading. The number of deaths reported to have occurred from fever during the year was 1,634,254 or 22·99 per 1,000 of population, against 1,799,833 or 25·32 in 1894. Just a half of the 46 districts recorded a higher fever mortality than the provincial rate, seven registering a rate over 30 per 1,000. With only one exception (Hooghly) the soil of the districts with highest fever mortality is alluvial, "and the natural drainage has been more or less obstructed by "changes of level and the shifting of the courses of the rivers." At the same time Dr. Dyson points out that malarial fever is by no means confined to alluvial areas with defective drainage. "The malarial parasite," he says, "seems to be in evidence all over "the province, and requires but certain modifications of heat, moisture, and organic "matter present to excite it to active propagation, one of the chief factors which "influence this being moisture as determined by rainfall and subsoil water "fluctuation."

From dysentery and diarrhœa 49,871 deaths were registered, equal to 0·70 per 1,000 of population, against 58,812 or 0·82 in the previous year. Of the districts, Calcutta

returned the highest death-rate from these causes (4·79), Howrah came next (4·65), followed by Darjeeling (3·90), Balasore (3·21), and Puri (3·20). These five districts have headed the list, though in a different order, for the last three years.

In Calcutta the birth-rate was only 16·0 per 1,000, the lowest on record since 1889, while the death-rate (39·6) was the highest. The increase in the number of deaths, from 22,441 in 1894 to 27,031 in 1895, is reported to be due to fevers and small-pox, those from the former having risen from 8,963 to 11,345, and those from the latter from 405 to 2,220. Cholera also was more prevalent than in the previous year, and the deaths from it rose from 1,695 to 2,090. Professor Haffkine's method of inoculation as a prophylactic against the disease was carried on during the year and 2,038 operations were performed. Dr. Simpson, the Health Officer of the city, examined the evidence as to the efficacy of this process, and expressed his opinion that "by precise observations "it has been proved that the anti-choleraic inoculations reduce the mortality in the "first four days by an average of 3·24 times, and that the people inoculated after this "period acquire a protection which for a year at least renders them 22·62 times safer "than the uninoculated." Of the 2,220 deaths from small-pox about a third (708) occurred among children under five years of age who had not been protected by vaccination, inoculation, or a previous attack of the disease; while on the other hand there was not a single death from it amongst vaccinated children of that age. This contrast, the Army Sanitary Commission point out, "places the prophylactic value of "vaccination in the strongest light."

North-Western Provinces and Oudh.

The year 1895 in the North-Western Provinces and Oudh was exceptionally healthy. The birth-rate, however, was low, viz., 34·90 per 1,000 of population, as compared with 39·70 in the previous year, and a decennial mean of 39·50. The diminution was attributed to the extreme unhealthiness of the year 1894, the mortality returns of which, the officiating Sanitary Commissioner, Dr. Thomson, observes "are in themselves sufficiently indicative of the great amount of fatal disease, but they "only partially show the extent of sickness, and consequent vital depression, existing." The number of births registered during 1895 was 1,637,235, against 1,862,025 in the previous year. The births, however, exceeded the deaths by 270,792, or 5·77 per 1,000. An examination of the district ratios shows that, as in the previous year, Bulandshahr headed the list with a birth-rate of 55·43, Aligarh, Etah, and Agra followed with ratios of 52·36, 51·29, and 51·04 respectively. Out of the 48 districts, 24 recorded birth-rates above the average for the provinces. The town birth-rate was 39·80, and that for rural areas 34·29. Among the former there were great deviations from the average, the extremes, excluding hill stations and Brindaban, where the circumstances are peculiar, ranging from 64·27 in Fatehpur Sikri, to 24·83 in Saharanpur.

The number of deaths registered was 1,366,443 or 29·13 per 1,000 of population, being 627,335 or 13·38 less than in 1894. The highest district death-rate was that of Kheri 44·54, Naina Tal (which includes the Terai) followed with 43·57, and next in order came Hamirpur 40·89, and Saharanpur 40·79; the lowest rates were recorded by Partabgarh, Allahabad, Mainpuri, and Ballia, these ranging from 21·97 to 20·71. Eleven districts showed an excess of deaths over births, against 20 in the previous year. The town death-rate was 33·46, and the rural death-rate was 28·58, as compared with 47·67 and 41·85 respectively in 1894, the former being made up of ratios varying between 75·64 per 1,000 in Deoband and 17·28 in Bareilly. Though still capable of improvement, registration of vital statistics in these provinces is considered to be, on the whole, extremely efficient. An examination of registers by local authorities disclosed an omission of 2·78 per cent. on 21 per cent. of the births and 2·64 on 20 per cent. of the deaths, while, of 241,988 cases tested by the Vaccination Department, the omitted percentages were 1·46 of births and 0·72 of deaths.

The history of the chief diseases shows that the mortality from cholera declined from 178,079 or 3·80 per 1,000 in 1894 to 51,562 or 1·10. The disease prevailed in an epidemic form in the Fyzabad and adjoining districts in the early part of the year and in Hamirpur in the rains. Hamirpur headed the districts with a cholera death-rate of 7·56, followed by Fyzabad 5·51, Basti 4·3, Sultanpur 4·21, Gonda 2·85, Rae Bareli 2·53, Azamgarh 2·42, and Shahjahanpur 2·08. In five other districts the rates varied between 1·72 and 1·11, while the Kumaun division, comprising the districts of Almora, Garhwal, and Naini Tal, were absolutely free from the disease, as were also the Hardwar and Magh Mela fairs. Of the larger towns Fyzabad and Shahjahanpur were the only ones which recorded high cholera death-rates, viz. 5·83 and 3·75 respectively.

The continuous diminution of small-pox in these provinces, which has become more and more pronounced during the past 26 years, was further shown by a reduction in the death-rate from ·09 in 1894, hitherto the lowest rate recorded, to ·04 in 1895, in which year there were 1,968 deaths. The highest district rates were 0·37 in Pilibhit, 0·30 in Kheri, and 0·27 in Jhansi. No deaths from small-pox were recorded in Bijnor district, and in 16 other districts the number of fatal cases was below 10. Out of 100 principal towns in the provinces small-pox was present only in 27, and of these Cawnpore recorded the highest ratio of 0·35.

Comparatively speaking, the mortality from fever was not great. The number of deaths registered under this head in 1895 was 1,093,212 or 23·31 per 1,000 against 1,495,372 or 31·88 in the previous year. The percentage of deaths to total mortality was 80, but little reliance can be placed in this figure as so many diseases are registered under fever. Dr. Thomson observes that many of the deaths were no doubt due to influenza, which was prevalent during the year in several districts. Among the districts Kheri came first with a fever death-rate of 41·99, closely followed by Naini Tal with 40·06; Saharanpur and Pilibhit come next with ratios of 39·23 and 35·24 respectively. Of the larger towns, Muzaffarnagar was the only one showing an exceptional fever mortality, viz., 43·87.

There were 42,778 deaths recorded under dysentery and diarrhœa, being equal to 0·91 per 1,000, as compared with 66,173 or 1·41 in 1894. As usual the death-rates were highest in the hill tracts, Garhwal showing 9·73, Almora 4·83, Dehra Dun 4·88, and Naini Tal 2·10. In the plains the highest rates were Jhansi 3·12, Rae Bareli 2·85, and Bareilly 2·36. The town death-rate from these causes was 2·35, as compared with 0·80 in rural areas. Kashipur, a town in the Terai, again recorded the highest mortality (12·84) under this head.

The year 1895 in the Punjab was a healthy one; the meteorological conditions were more favourable to health, the weather was mild, the rainfall was below the average, and there was no unusual prevalence of epidemic disease. The number of births registered during the year was 901,584 or 43·86 per 1,000 of population, against 902,941 or 43·93 in 1894. The district birth-rates ranged from 54·4 to 37·2. In five districts the birth-rate exceeded 50 per 1,000, viz., Gujranwala 54·4, Jhang 51·9, Gurgaon 51·7, Rohtak 50·9, and Ferozepore 50·7. The comparatively low rates of Amritsar 42·7, Gurdaspur 39·7, Jullundar 39·1, Umballa 38·7, and Hoshiarpur, 37·2, the Sanitary Commissioner, Dr. Roe, attributes to the unhealthiness of these districts in the previous year. The registration of births in the frontier districts continued to improve, especially in Kohat and Bannu, where the averages for the five years ending 1893 of 25·9 and 27·2 respectively, rose in 1894 to 40·4 and 39·6, and in 1895 to 42·0 and 44·2. In rural circles the average birth-rate was 44·3 per 1,000, as compared with 40·0 in the towns. Among the latter, seven returned rates of over 50 per 1,000. Pun

The number of deaths registered in the province in 1895 was 601,972, equal to a death-rate of 29·29 per 1,000 of population, against 750,681 or 36·52 in the preceding year. With four exceptions the mortality of 1895 was the lowest recorded during the previous ten years, and the rate was only 1·16 per 1,000 in excess of that recorded in 1893 (28·13) which was a very healthy year. Simla and Umballa were the only districts in which the deaths exceeded the births. In 12 districts out of 27 the provincial death-rate was exceeded, and in these the rates varied from 42·55 in Umballa to 29·86 in Kohat. In rural circles the average death-rate was 28·8 per 1,000, as compared with 33·7 in the towns. Among the larger towns, Jagadhri returned the highest rate of 50·12 per 1,000, and in eight more the rates varied between 43 and 40 per 1,000.

There was again very little cholera in the province during the year, the deaths from the disease numbering only 549. Of these, 511 occurred in the Umballa district, 31 in Karnal, 4 in Peshawar, and single deaths only in Delhi, Jhang, and Rawalpindi districts. The mortality, however, was in excess of the previous year by 436, there having been but 113 cholera deaths recorded in 1894. It is worthy of notice that within the last 29 years the cholera death-rate in this province has only three times exceeded one per 1,000.

The mortality from small-pox was higher than in 1894, the deaths having risen from 6,068 or 0·30 per 1,000 in that year to 8,334 or 0·41 in 1895, being an increase of 2,266. 92 per cent. of the deaths occurred among children under 12 years of age, nearly 30 per cent. being infants. Only in four districts did the death-rate from this cause exceed 1 per 1,000, viz., Dera Ismail Khan 1·56, Hissar 1·52, Peshawar 1·33,

and Gurgaon 1·06. In some places outbreaks of the disease were attributed to the operations of inoculators. It was suggested that these men should be induced to give up inoculation and become vaccinators, but the Army Sanitary Commission point out that "experience in other provinces has shown that converted inoculators rarely "become good vaccinators."

Deaths ascribed to fevers were less by 123,120 than in 1894, the number having fallen from 515,238 or 25·07 per 1,000 to 392,118 or 19·08. The provincial rate was exceeded by 14 out of the 31 districts, the highest being recorded by Umballa, viz. 29·14, followed by Kangra 24·37, and Kohat 23·85. In the rural areas the average fever death-rate was 19·15, and that of municipal towns 18·03. Of late years the "mortality from fevers in this province, the Sanitary Commissioner (Dr. Roe) states "seems to be steadier and more nearly approaching the truth than in the early part "of the eighties. This possibly may be due to improved registration, but also and "most probably to drainage works constructed in some of the worst places, and the "arrangements made to avoid the occurrence of heavy floods.

From dysentery and diarrhœa 15,648 deaths were registered, being in the ratio of 0·76 per 1,000 against 17,983 or 0·87 in 1894. The districts showing the greatest mortality under this head were Simla 3·26, Umballa 1·70, Delhi 1·62, Gurgaon 1·44, Kangra 1·31, Amritsar 1·21, Karnal, 1·18, and Gurdaspur 1·12.

Burma.

Some slight progress was made in the registration of vital statistics in Lower Burma during 1895, but there is still much room for improvement. The total number of births recorded was 131,147, equal to 29·04 per 1,000 of the population, which was the highest ratio on record. In the previous year 124,753 births were registered, representing a ratio of 27·62 per 1,000. "The rise in the birth-rate," the Chief Commissioner remarks, "is satisfactory, but it should be remembered that the rate is calculated "year after year on the same basis, namely the census figures of 1891, and "consequently that, unless registration grew annually worse, the returns should show "a slight increase in rate from year to year. The same remark applies to the "death-rate." The district rates ranged from 38·79 in Sandoway to 22·88 in Amherst, and those of towns from 99·95 in Letpadan to 11·56 in Kyaukpyu. The excess of births over deaths was nearly 7 per 1,000.

The year was not specially unhealthy, and there was a small decrease in mortality. The number of deaths recorded fell from 106,740 or 23·56 per 1,000 in 1894, to 101,160 or 22·40. The variations, however, in the district and town rates are so great, ranging from 31·27 in Akyab and 15·88 in Amhurst in the former, and from 58·58 in Letpadan to 9·64 in Gyobingank in the latter, "that the general average for "the province can hardly be regarded as even approximately correct."

Cholera was not so prevalent as in 1894, and the deaths from it fell from 7,428 or 1·64 per 1,000 to 5,150 or 1·14. The disease was present throughout the year and visited all the districts, though two, Tharrawaddy and Tavoy, recorded only two deaths each. It was specially severe in the Akyab district, where the deaths amounted to 1,458, of which 202 occurred in the town, the district rate being 3·50 per 1,000, the highest rate recorded; Myaungmya came next with 3·29, Sandoway 3·16, and Kyaukpyu 2·23, and in four other districts the provincial rate was exceeded. The average rate of towns and rural areas was the same, 1·14 per 1,000. Out of 35 towns 11 escaped cholera altogether.

From small-pox 1,540 deaths were reported in the province, representing a ratio of 0·34 per 1,000, as compared with 1,737 or 0·38 in 1894. Of the 1,540 deaths, 1,280 occurred in the four districts of the Irrawaddy division, Henzada district alone contributing 864, equal to 1·97 of its population. This was the only instance in which small-pox mortality reached 1 per 1,000. As in the preceding two years the disease was prevalent in the four districts of the Irrawaddy division in every month. In all four districts inoculators are reported to be largely at work, and opposition to vaccination except in the Karen villages is very pronounced. Of the total small-pox deaths, just over 80 per cent. occurred amongst children under 12 years of age, infants contributing 22·6 per cent.

The mortality registered under fevers was about the same as in 1894, viz. 48,049 or 10·64 against 48,104 or 10·65. The death-rate was highest in the districts of Akyab (21·28), Thayetmyo (16·55) and Prome (14·77). In five others the provincial rate was exceeded, and in the remainder the rates ranged from 10·15 to 5·80. The death-rate for the towns was 7·57 and for the rural areas 11·08.

Dysentery and diarrhœa accounted for 8,794 deaths, giving a ratio of 1·95 per 1,000 of the population, the highest on record, against 1·92 in 1894. By districts the

highest mortality under this head was 4·40 in Akyab and the lowest 0·44 in Henzada. The Sanitary Commissioner attributes the increase to "more accurate classification," and not to an unhealthy season, for, as already shown, the mortality from all causes was lower than in 1894.

Central Provinces.

The year 1895 in the Central Provinces was not a healthy one, though the mortality was slightly less than in the preceding year. There was a deficiency of rain, which while favouring an abatement of fever, on the other hand caused a scarcity of good drinking water, and brought the usual consequence of cholera and bowel complaints. The dryness of the year also affected the crops, and there having been a series of bad harvests previously, the people suffered from want of food "or eked out a subsistence "with inferior and unwholesome articles of diet."

There was a great falling off in registered births, the number being 317,432 or 33·41 per 1,000, the lowest recorded for 15 years, and 51,454 or 5·41 less than in 1894. Out of the 20 districts all but four showed a decrease in their birth-rates as compared with the previous year, the diminution being due to a lowering of vitality among the population at large caused by hard times. Only three districts recorded rates of over 40 per 1,000, and in 14 the birth-rates were lower than the death-rates. Saugor is quoted as an instance of the influence which unfavourable conditions exercise on the fecundity of the people. In this district less than half the number of births were recorded in 1895 (12,243) as compared with the previous year (24,642), though probably the decrease to some extent was due to defective registration.

The registered mortality of the year was 349,137 or 36·75 per 1,000, against 353,606 or 37·22 in 1894, when influenza and fevers were the main causes of this high mortality. "Excluding the effects of epidemic influenza," the Sanitary Commissioner (Dr. Newman) writes, "and allowing for the lessened mortality from fevers, "it is certain that last year was even yet more unhealthy than its predecessor, and "therefore, the worst of any year, excepting 1889, within the last ten." The district death-rates ranged between 57·06 in Nimar and 22·73 in Sambalpur. The average death-rate in municipal towns was 40·07 as compared with 36·55 in rural circles. Among the former there were 12 with ratios of over 50 per 1,000, including Badnur 78·38, Multai 73·89, the ratios of the other ten ranged from 64·22 to 51·34. There was an excess of deaths over births in 35 of the 47 municipalities.

All the chief diseases except fevers were considerably more fatal than in 1894. The deaths from cholera numbered 15,506, equal to 1·63 per 10,000 of the population, as compared with 7,043 or 0·74 in the previous year. The disease was present in every district, but it was most fatal in Nimar, Narsingpur, and Chanda, which recorded death-rates from it of 7·37, 5·96, and 5·42. Deaths also occurred in every month of the year, the worst months being August, September, and June. It was more destructive in the towns than in the rural areas, the average mortality of the former being 2·33, and that of the latter 1·57. Out of 72 towns, 32 were exempt from the disease, and in several the mortality was low, but others suffered very severely, among them being Badnur with a ratio of 20·14, Lakhnadon 18·79, and Bhandara 15·81.

From small-pox the deaths were unusually high, numbering 6,644 or 0·70 per 1,000, against 1,500 or 0·16 in 1894. The disease was particularly prevalent in the districts of Nagpur, Jubbulpore, and Wardha, where the deaths were equal to ratios of 2·44, 1·56, and 1·45 respectively. Of the total deaths from small-pox 74 per cent. occurred among children under 12 years of age, of whom 30 per cent. were infants. The death-rate in the towns was 1·96 per 1,000, or more than three times that of the rural areas, which was 0·58. Only 13 of the towns were exempt from the disease, while 16 recorded death-rates of over 3 per 1,000.

About two-thirds of the total mortality were ascribed to fevers. The deaths numbered 221,418 or 23·30, showing a decrease of 17,133 or 1·81 on the previous year. The provincial death-rate from fever was exceeded by 12 out of the 20 districts, the highest being 44·52 in Nimar, 36·86 in Saugor, 32·16 in Narsinghpur, 31·41 in Hoshangabad, and 30·14 in Damoh. As usual the worst months were September, October, November, and December. The average town mortality from this cause was 19·32 per 1,000, which was made up of ratios ranging from 57·55 in Charwa in Hoshangabad district to 3·51 in Markher in Nagpur district in Sambalpur. The average rural mortality was 23·68.

The registered mortality from dysentery and diarrhœa was 20,316 or 2·14 per 1,000, as compared with 16,880 or 1·78 in 1894. These complaints were in a marked degree the concomitants of distress, and prevailed chiefly in Jubbulpore, Narsinghpur, Hoshangabad, Saugor, and Damoh, whose death-rates ranged from 4·65 to 3·83. Dr. Newman observes that "it seems very doubtful that even a fair proportion of

" deaths from dysentery are reported as so caused. In looking through village " records I rarely found entries of this disease, and it is often in epidemic seasons " taken for cholera. One Civil Surgeon remarks that the people seldom admit " dysentery as the cause of death, and another says that many more cases occur than " are shown in the registers. Both are, I think, correct."

Assam.

Registration of vital statistics in Assam is still very backward, the figures are therefore unreliable, and useful only for purposes of comparison, a remark which also applies to several other provinces. The total number of births registered during 1895 was 155,631, giving a ratio of 31·0 per 1,000 population, as compared with 156,153 or 31·10 in the previous year. As in 1894 the highest birth-rate was recorded by Goalpara district, viz., 42·29, and the next highest rates were 34·05 and 31·09 respectively registered in the Cachar and Sylhet districts, these being the only three instances in which the provincial rate was exceeded, as the rates of the remaining districts ranged from 29·05 in Lakhimpur to 22·07 in Nowgong. "There is little " doubt," Dr. Stephen, the Sanitary Commissioner, remarks, "that in 1895 not less " than 30 per cent. of the births in this province were not registered."

Deaths were more accurately recorded than births, and taking 42 per 1,000 as representing, approximately, the normal death-rate, the Chief Commissioner estimates that about 19 per cent. escaped registration. The deaths registered during 1895 aggregated 169,304, exceeding the births by 13,673 and the mortality of 1894 by 15,213. The death-rate was 33·72 per 1,000 of population as compared with 30·69 in 1894. In the Surma Valley, comprising the districts of Cachar and Sylhet, the average mortality rose from 27·62 in 1894 to 32·37, both districts contributing to the increase; in the Brahmaputra Valley the average death-rate was 35·33 as compared with 34·04 in the previous year. Of the six districts in this division Goalpara recorded the highest mortality of 42·72 per 1,000, closely followed by Nowgong with 42·28, the ratios of the remaining four districts ranging from 37·76 to 28·82.

Cholera was more fatal than in 1894, the number of deaths having risen from 13,497 or 2·69 per 1,000 to 18,962 or 3·78. The disease prevailed throughout the year and visited every district. Some of the districts recorded a very high cholera death-rate, notably Kamrup and Goalpara in the Brahmaputra Valley with 8·14 and 6·73 respectively. In the Surma Valley districts of Cachar and Sylhet the rates did not reach 3 per 1,000; but the lowest ratio (0·91) was recorded by Nowgong. The average death-rate from cholera in the towns was 4·72 per 1,000. In some of them this ratio was greatly exceeded especially by the Sadr towns of Tezpur and Dibrugarh which registered ratios of 13·46 and 10·63 respectively. Dr. Haffkine's anti-choleraic inoculations were continued up to July 1895, when he left the province, and the work was taken up by Surgeon-Captain Hare. The former inoculated 11,665 coolies on tea gardens, the results showing attacks at the rate of 8·39 per 1,000, and deaths at 3·73 per 1,000, while amongst the non-inoculated 12·13 per 1,000 were attacked, and 7 per 1,000 died. Dr. Hare inoculated 196 out of 355 Khasi coolies, and of these only four were attacked by cholera, but all died. Of the remainder 34 were attacked and 30 died, the ratios per 1,000 of the inoculated who were attacked and died were 20·41 in both cases, as compared with 213·84 and 188·68 respectively for those not inoculated. "The results," the Chief Commissioner observes, "go further than any " yet reported towards establishing the prophylactic efficacy of Dr. Haffkine's system " of cholera inoculation for at least a short period after inoculation."

Small-pox was slightly less prevalent than in the previous year, the deaths numbering 3,849 or 0·77 per 1,000, against 3,997 or 0·80. The highest rates were returned by Goalpara (1·18), and Kamrup (1·11); but though the former was the highest, it was much smaller than in the previous year (6·11), the number of deaths having fallen from 2,762 to 552. The Civil Surgeon of Goalpara reports that villagers persistently refuse to allow their children to be vaccinated. In the Sadr and divisional towns, in most of which vaccination is compulsory, the small-pox death-rate rose from 0·56 to 5·35 per 1,000, the increase being due chiefly to the heavy mortality in Barpeta, a town of about 12,000 inhabitants (where vaccination is not compulsory), which recorded 433 deaths, or 36·43 per 1,000, against nil in 1894. The disease was also severe in Dibrugarh town (11·64). Excluding these two towns, the urban mortality is reduced to 0·22 per 1,000. Of the total small-pox deaths, 25 per cent. occurred among infants, and 53 per cent. among children between the ages of 1 and 12 years.

Over 54 per cent. of year's mortality were ascribed to fevers, including kala-azar. The number of deaths registered from them was 92,359, representing 18·39 per 1,000 of the population, against 85,102, or 16·95 in 1894. There was a considerable increase

in the deaths ascribed to fevers in the Surma Valley districts of Cachar and Sylhet, and in Nowgong. In the last of these three the mortality reached the high rate of 37·17 per 1,000. The next highest fever death-rates were 29·24 and 22·90, respectively returned by Goalpara and Darrang. Of the 15,894 kala-azar deaths, 11,037 occurred in the Nowgong district, an increase of 2,452 on the number of the previous year; it is believed, however, that a large proportion of the deaths returned under kala-azar in this district were due to ordinary malarial fever. Owing to the high mortality from kala-azar in Nowgong and its continued prevalence in other places, a junior medical officer has been appointed with a view to the systematic and continuous observation of the disease.

Under dysentery and diarrhœa 15,523 deaths were registered, yielding a ratio of 3·09 per 1,000 of population, as compared with 14,769 or 2·94 in 1894. As usual, these diseases were most prevalent in Lakhimpur and Sibsagar with death-rates of 7·79 and 5·12 per 1,000 respectively. The mortality reported under these heads in Cachar district was also high, viz., 4·58 per 1·000.

Madras.

The year 1895 was a healthy one in Madras Presidency. The rainfall was above the average, and food prices were lower than in the preceding year, though they were still above the average for the ten years ending 1892. The number of births registered during the year was 976,572 or 29·1 per 1,000, against 933,059 or 27·7 in 1894. The increase was spread over 16 of the 22 districts. Excluding Madras town, which recorded a birth-rate of 42·5, Chingleput registered the highest ratio of 38·4, and in six other districts the rate was above 30 per 1,000, while in Godavari, Malabar, and Ganjam, it ranged from only 24·3 to 17·3. Among the 57 municipalities, two recorded birth-rates over 45 per 1,000, 22 over 35, 20 over 30, and 13 below. The mortality in 1895 was less than that recorded in any of the preceding four years except 1893; the registered deaths numbered 658,719 or 19·6 per 1,000, as compared with 672,668 or 20·0 in 1894. By districts the highest death-rate was, as usual, recorded in Madras, viz., 38·0; "a result which may be partly ascribed to the greater accuracy of the "returns, and partly to the insanitary condition of that city." In the other districts the mortality ratios ranged from 25·0 per 1,000 in Tinnevelly, to 13·6 in Ganjam. The average death-rate of the towns was 27·2 per 1,000, and that of rural areas 19·0.

Of the chief diseases, cholera was considerably less fatal than in 1894, the number of deaths having fallen from 42,289 or 1·3 per 1,000 to 21,172, or 0·6, a lower mortality than had been recorded in any year since 1887. All the districts except Godavari, Kistna, and the Nilgiris were affected, but it was most fatal in Tinnevelly and South Arcot, which recorded 4,649 and 4,307 cholera deaths respectively. The average death-rate in municipal and other towns from the disease was only 0·8 per 1,000, against 2·1 in 1894, and that in rural tracts 0·6, against 1·2. Among the 57 municipalities a total of 1,447 cholera were registered. In nine of them the deaths did not exceed ten in each; while the chief sufferers were Trichinopoly (290 deaths), Chidambaram (216), and Madras and Periyakulam (115 each).

Small-pox deaths were reported from all the districts, but the total in the whole Presidency was only 5,111 or 0·1 per 1,000, against 11,207 or 0·3 in 1894. Of the districts the disease was severe in those of Anantapur, Bellary and Kurnool, which recorded death-rates of 0·5, 0·6, and 0·6, respectively, while in Malabar, where it was very destructive in previous years, the mortality was only 0·03 per 1,000; but the lowest ratio (0·006) was recorded as usual in Madras, where there were only three fatal cases. Of the total 5,111 small-pox deaths 1,111 or 21·7 per cent. occurred amongst children under one year of age, and 1,966, or 38·4 per cent. among those between 1 and 12 years of age.

From fevers the registered deaths showed an increase of 6,881 on the previous year, the number having risen from 270,456 or 8·0 to 277,337 or 8·3; but "in the existing "state of death registration," the Army Sanitary Commission observe, "it is not "easy to say whether this increase was due to greater prevalence of fever, or the "results of increased attention to registration." In four of the districts the fever mortality was over 15 per 1,000, viz., 19·2 in Nilgiris, 18·2 in Vizagapatam, 16·0 in Cuddapah and 15·1 in Kurnool. All these are more or less malarious districts, but, as pointed out, if the ratios of the two first be accepted "it must be supposed that "only 2·5 of the total mortality of 20·7 per 1,000 in Vizagapatam, and 5·7 of that of "24·9 in the Nilgiris were due to any cause but fever." Eleven of the 57 municipal towns returned fever death-rates exceeding 11 per 1,000, the highest being 18·3 in Cuddapah, followed by 14·2 in Madras.

The deaths registered under dysentery and diarrhœa numbered 23,937 or 0·7 per 1,000, against 24,801 or 0·8 in the previous year. The town death-rate under this head was 2·9, as compared with 0·5 in the rural areas; and while, in municipalities, the average mortality was 3·4, in districts it was only 0·7. "Even making "allowance for indifferent registration," Dr. King, the Sanitary Commissioner of the Presidency, writes, "I consider the result sufficiently striking in pointing to the "influence of the usual concomitant of communities living under the evil hygienic "conditions found in most of the municipalities up to date, namely, foul and damp "soil, and water subject to fæcal contamination; where to these conditions the use of "brackish water is added, the incidence of diarrhœa and dysentery becomes greater, "for example, at Vizagapatam, Karur, and Tuticorin, where the rates range from 10·3 "to 7·6, and 6·3 respectively."

Bombay.

In the Presidency of Bombay, including Sind, 674,304 births were registered during 1895, or 14,036 in excess of the number recorded in the previous year, the birth-rates per 1,000 of population being 35·83 and 35·08 respectively. Of the 24 collectorates and districts 15 showed an increase and 9 a decrease as compared with the previous year; but only in seven were the rates over 40 per 1,000, the highest being 47·66 in Ahmednagar, followed by 45·65 in Khandesh. The lowest rates were recorded by Hyderabad (19·32) and Bombay (19·07), the latter showing a slight improvement on the registered rate of the previous year (18·35). There are various exceptional circumstances which account for the low birth-rate of the Presidency city, but the disparity apparently is due to some extent to the omission to register births, for the Government in reviewing the Sanitary Commissioner's report point out that "only last "year the vaccinators discovered 5,617 infants under one year of age whose births "had not been registered." Owing to the healthiness of the year the number of deaths recorded fell from 607,179 or 32·26 per 1,000 in 1894 to 538,540 or 28·61, the average being made up of district rates ranging from 14·62 in Hyderabad to 39·68 in Sholapur. Only in five out of the 24 districts were the recorded death-rates higher than in 1894, the increase in some cases being very trifling.

Cholera was considerably less prevalent in the Presidency in 1895 than in the previous year. Only 8,890 deaths or 0·47 per 1,000 were registered from it as compared with 33,588 or 1·78 in 1894. More than half of the mortality was confined to four districts, viz., Dharwar 1,585, Satara 1,354, Sholapur 1,137, and Khandesh 1,002. The province of Sind was again free from the disease, and in the district of Broach there was only one fatal case and in Surat only five. Deaths occurred in every month of the year, the maximum of 1,652 being reached in August. The average urban death-rate from cholera was 0·44 per 1,000 against 0·48 in the rural areas. More than half the towns escaped the disease, while some were severely affected, notably Pandharpur in Sholapur district, which recorded a cholera death-rate of 17·24 per 1,000. The Sanitary Commissioner with the Government of India (Dr. Cleghorn) observes that "in recent years little has been done to improve the "sanitary state of this town, the energies and money of the municipality being devoted "to the construction of a high school and the building of a bridge."

The number of deaths from small-pox fell from 3,155 or 0·17 per 1,000 in 1894 to 2,299 or 0·12 in 1895. All the districts except Panch Mahals recorded deaths from the disease, but in no case did the mortality reach 1 per 1,000, the highest death-rate being 0·40 in Kolaba. According to age 26·66 per cent. of the deaths occurred amongst infants, whilst 54·59 per cent. took place among children between one and 12 years of age.

The mortality ascribed to fever during the year though much larger than the decennial mean showed a considerable decrease as compared with that of 1894, the deaths numbering 388,848 or 20·66 per 1,000 against 429,094 or 22·80. The average rate of the Presidency was exceeded in 11 districts, among the highest being Sholapur 30·75, Ahmednagar 28·33, Satara 28·15, Khandesh 27·39, and Nasik 25·92. The most striking decrease in fever mortality occurred in the Gujarat Registration District, comprising the collectorates of Surat, Broach, Kaira, Panch Mahals, and Ahmedabad, where the number of deaths fell from 109,183 in the previous year to 70,258. In the towns the average death-rate from fever was 15·62 per 1,000, a ratio made of extremes ranging from 40·67 to 6·05. In the rural areas the average rate was 21·36 per 1,000.

From dysentery and diarrhœa the registered deaths rose from 34,667 or 1·84 per 1,000 in 1894 to 35,348 or 1·88 in 1895. In 12 districts the death-rate under this head showed an increase, and among the highest Sholapur came first with a ratio

of 4·34, Satara 3·88, Belgaum 3·65, Nasik 3·64, and Ahmednagar 3·42. In the remaining districts the ratios ranged from 3·09 in Khandesh to 0·04 in Panch Mahals and in Upper Sind Frontier.

Although the climatic conditions were favourable and food was cheap in Berar during 1895, the public health was not so good as in the previous year. The total number of births registered in the course of 1895 was 105,952 or 37·2 per 1,000 of population, showing an increase of 11,193 or 3·9 on the previous year. In the six districts of the province the birth-rates varied considerably, the largest being 44·2 in Buldana and the lowest 27·3 in Basim and 25·4 in Wun, but all recorded a higher rate than in 1894 except Basim where there was a small decrease of 0·1 per 1,000. Regarding the low ratios recorded by Basim and Wun, the Sanitary Commissioner, Dr. Little, reports that birth registration is most defective in them, though he thinks the falling off as compared with previous years was also due to other causes. He personally examined the registers in several villages of both districts and was struck by the high death and low birth rates recorded, yet in most instances he found the registers were pretty accurately kept. In the towns the average birth-rate was 40·1 and in the rural areas 36·9. Berar.

The deaths rose from 119,561 or 42·0 per 1,000 in 1894 to 141,937 or 49·9, "a rate "which has only been exceeded twice in the last 28 years." The increase of 22,376 deaths occurred chiefly under cholera and dysentery and diarrhœa, together accounting for an increase of 18,093 deaths. As in the case of births Wun district recorded the lowest death-rate (41·6), whilst Basim which came next to Wun in regard to low birth-rate recorded the highest death-rate of 58·4, Buldana coming next with 55·3, the remainder being as follows:—Ellichpur 51·9, Akola 48·6, and Amraoti 47·0. In towns the average death-rate rose from 41·6 in 1894 to 46·4 which was made up of ratios ranging from 76·0 to 32·9. In 14 towns the mortality was excessive, varying between 76 and 53 per 1,000.

Cholera was again epidemic during the year, and was the cause of 11,919 deaths or 4·2 per 1,000 of population against 3,452 or 1·2 in 1894. The disease affected every district, and prevailed throughout each month of the year. According to districts the greatest mortality was recorded in Basim, where there were 3,976 cholera deaths, equal to a ratio of 10 per 1,000, exceeding the mortality registered under this head in the whole province in 1894. Dr. Little notices that in epidemic years this district suffers very severely. "Why this should be so," he writes, "it is difficult "to explain. The local sanitary conditions of the villages in the Basim district are, "if anything, better than those of the other districts in the province, so that local "insanitary conditions do not account for the comparative relative intensity of cholera "epidemics in this district." Next to Basim, the Buldana district suffered the most severely, returning a cholera death-rate of 5·8 per 1,000; Wun district followed with a ratio of 4·5, all three showing a considerable increase on the rates of the previous year; in each of the other three districts also the cholera mortality was higher than in 1894. The average urban and rural death-rates from cholera were 3·2 and 4·3 per 1,000 respectively. Only 11 of the 37 towns escaped the disease, and in five the death-rates exceeded 10 per 1,000.

There was a marked reduction in the mortality from small-pox which is attributed to the spread of vaccination. Only 556 deaths were registered, giving a ratio of 0·2 per 1,000 of population as compared with 1,061 or 0·3 in 1894. The greatest number of deaths (205) was registered in the Buldana district and the fewest (25) in the Basim district. Of the total small-pox deaths 181 occurred in the towns and 375 in rural circles. Ninety-three per cent. of the deaths occurred amongst children under 12 years of age, 205 or 36·9 per cent. being infants under one year.

Under fevers a mortality of 66,203 or 23·2 per 1,000 was registered, against 67,070 or 23·6 in 1894. "A curious feature of this high mortality," the Commissioner observes, "is that it contradicts previous experience in regard to the relation between "rainfall and prevalence of fevers, for the year 1895 was remarkable as being a "peculiarly dry year, with only 27 inches of rain. Yet the ratio of deaths from fever "was 23·2 as compared with a mean of 17·7. We are evidently far from a knowledge "of the seasonal causes of this disease, though its prevalence at certain times is "fairly established." By districts the death-rates from fever varied between 27·7 in Wun and 21·2 in Amraoti. Regarding the high mortality in Wun, Dr. Little again points out that the "district is very malarious owing to the general conditions of the "country as regards forests, uncultivated lands, &c. Endeavours have been made "to alleviate the evil by the sale of cheap quinine, but the aboriginal Shond and Kulam

" inhabitants are too ignorant to avail themselves of the remedy. These people are " very poor, scantily clad, and live from hand to mouth. They usually work as field " labourers, and in seasons of scanty harvest almost starve, sustaining life with jungle " fruits, specially the mowha blossom and the seeds of grasses. They are improvident, " intemperate, and uncleanly, and the mortality amongst them, their young especially, " must be very high."

The number of deaths attributed to dysentery and diarrhœa was 24,452 or 8·6 per 1,000, which shows a great increase on 14,886 or 5·2 recorded in 1894. Ellichpur district, as usual, recorded the highest mortality under this head, viz., 13·8, a ratio which had not been surpassed for 23 years. Akola followed with 10·3, and the other district rates ranged from 9·3 in Basim to 2·8 in Wun.

IV.—JAILS.

Sickness and mortality in 1895.

Judged by the mortuary statistics there was an improvement in the health of the jail population of India in 1895. The daily average sick per 1,000 of average strength rose from 39·29 in 1894 to 42·95, but the ratios of admissions into hospital and of deaths declined from 1,030 and 31·84 per 1,000 respectively, to 1,006 and 26·59. Of the ten provinces, all but Assam, the Punjab, and the Central Provinces, returned a lower jail death-rate than in 1894, the most noticeable cases being Bengal and Coorg. It will be observed from the table below that the mortality was highest in the Central Provinces, Assam, and Coorg. From cholera there were only 93 deaths as compared with 255 in 1893. In the jails of the Punjab, Berar, and Coorg, there were no deaths from this disease. There were more deaths from fevers, and dysentery and diarrhœa.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1895 as compared with the previous year.

Provinces.	1895.			1894.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,247	42	27·47	1,232	43	47·12
North-Western Provinces and Oudh	902	58	27·45	869	43	32·28
Punjab	1,451	35	21·81	1,758	39	18·73
Burma	892	38	17·93	876	43	28·78
Central Provinces	922	35	55·96	951	34	31·74
Assam	1,287	58	59·21	1,411	56	51·65
Coorg	591	16	42·86	575	24	58·41
Madras	643	26	18·18	628	25	19·85
Bombay	956	30	29·23	810	29	32·07
Berar	877	23	23·26	1,327	50	28·53
India	1,006	43	26·59	1,030	39	31·84

Bengal.

The sanitary history of the Bengal jails for 1895 is on the whole satisfactory. The year's statistics show a material improvement in the health of the prison population of the province, which was no doubt due partly to the healthiness of the year; but the diminished mortality is in great part ascribed "to careful super- "vision, and to the intelligent and effective manner in which local conditions "affecting the health of the prisoners have been met and overcome." The admissions into hospital were in the ratio of 1,247 per 1,000 of average strength against 1,232 in 1894, the average daily sick-rate was 42 or 1 per 1,000 less and the death-rate fell from 47·12 to 27·47, the lowest mortality on record for more than 50 years. Among all classes of prisoners there were 465 deaths, and of these 418 were convicts. The diseases which contributed largely to the convict death-rate (26·3) were dysentery and diarrhœa 155 deaths, respiratory diseases 61, scrofula and phthisis 38, and cholera 26. In the previous year there were 65 deaths from cholera among the convicts. The only serious outbreak of the disease occurred in the Dinajpur jail, where 13 prisoners died out of 15 attacked. Of the convicts who died in jail 27 per cent. were admitted in good health, 31 per cent. in indifferent health, and 42 per cent. in bad health. Out of 47 jails the average death-rate among convicts was exceeded in 22, the highest being 147·18 in Dinajpur against 37·5 in 1894, Chaibassa 126·6 against 239·7, and 105·7 in Chapra against 93·5. In ten others the mortality was over 50 per 1,000, and in four over 40 per 1,000. The high mortality of the Dinajpur jail was due to the outbreak of cholera referred to above, and to the bad state of health

of the prisoners on entering the jail, only 3 out of the 19 who died being admitted in good health. In the Chapra and Chaibassa jails also the condition of the convicts on admission materially affected their death-rates; for, in the former of these two jails, out of 29 deaths only five were admitted in good health, and in the latter out of 15 deaths only three were found to be in good health on admission. Medical committees were appointed during the year to inquire into the sanitary condition of several of the jails in which the mortality was excessive in the previous year, and the recommendations submitted were approved by Government, and some have already been carried into effect. "No pains," it is reported, "have been spared to improve "sanitation where defects could be found, and special attention has been directed to "the jails in which severe outbreaks of disease have occurred, or in which the general "mortality of the prisoners have been excessive. The question of diet has been "prominently before the medical officers during the year, and every opportunity has "been taken to vary the diet or substitute more nutritious food where this appeared "desirable." The water-supply of the jails also continued to receive attention, and steps were taken to remedy defects brought to notice.

North-Western Provinces and Oudh.

The year 1895 in the North-Western Provinces and Oudh being one of much scarcity among the free population, many of the admissions into the jails were in the last stages of want and emaciation. It is not surprising, therefore, the Inspector-General observes "that the sickness and mortality were high, though it will be "noticed that the jail death-rate was lower than in the previous year." The admissions into hospital rose from 869 per 1,000 of average strength in 1894 to 902, the daily average sick-rate from 43 to 58 per 1,000, while the death-rate declined from 32·28 to 27·45; this, however, it is stated, would have been much higher, but for the efforts made by medical officers in district jails to control the mortality. Of the 56 jails in the province, 11 recorded a death-rate of over 50 per 1,000, the highest being 137·07 in Moradabad. This high death-rate formed the subject of a special inquiry, when it was found that there had been great remissness on the part of the prison staff in the dieting of the prisoners. Of the staff's shortcomings suitable notice was taken. The high mortality in the Banda (99·13), Lalitpur (85·10), and Karwi (111·88), jails, was ascribed to the scarcity which prevailed in the Bundelkhand division. Several of the jails showed a distinct improvement in health, among them being the two combined jails of Gorakhpur, where the convict death-rate from all causes declined from 87·19 in 1894 to 39·82. Both the new and old jails were occupied during the year; the new one proved remarkably healthy, and the old one has now been vacated. Of the total 897 deaths in the jails, 836 were of convicts, the death-rate being 27·34. The mortality was highest among convicts during the first six months of imprisonment (35·26 per 1,000), and lowest among those who had been between two and three years in jail (10·36). The first of these is explained, to some extent, by the enfeebled state of health of the majority of the prisoners on admission, many having been sent direct to hospital. Dysentery and diarrhœa were the most fatal diseases among the convicts; the deaths from these amounted to 328; respiratory diseases followed with a mortality of 165, followed by anæmia and general debility, and fevers with 50 each. There was very little cholera in the jails, the deaths numbering only nine, of which three occurred in Fyzabad, and two in Partabgarh.

Punjab.

There was less sickness in the Punjab jails in 1895 than in the previous year, but the mortality was higher, though it was lower than in any of the preceding years except 1894. The admissions to hospital per 1,000 of average strength fell from 1,758 to 1·451, the daily sick-rate from 39 to 35, while the death-rate rose from 18·73 to 21·81, due to pneumonia, and an epidemic of influenza which appeared in many of the jails, but chiefly in the Montgomery Central Jail. Excluding the statistics of this jail, where the mortality was high (51 per 1,000), the average death-rate of the other 32 jails of the province was only 18·42, lower than any rate recorded in past years. But the highest death-rate was returned by the Lahore Female Jail, viz., 60·77, the result of 11 deaths. In four jails there were no deaths, and in 11 the mortality was below 15 per 1,000. In several other jails the death-rates were below the provincial average. Of the total 248 deaths, 105 or 38 per cent. were due to respiratory diseases, 22 being contributed by the Montgomery Jail alone. The disease was most fatal in December, when 45 deaths occurred. Among other diseases, dysentery and diarrhœa had 26 fatal cases, and scrofula and phthisis pulmonalis, 29. There was a marked decrease in the number of admissions under intermittent fever, which the Inspector-General ascribed to "the comparative healthiness of the autumnal months, and

" probably, in some measure, to the administration during the unhealthy season of " fever prophylactics, large quantities of which were supplied to all jails." Among convicts alone there were 235 deaths, equal to 22·05 per 1,000 of average strength, against 18·89 in 1894. Of these 91 had not been more than six months in jail, but the highest rate, according to length of residence, was among convicts who had passed three, and less than seven, years in jail (46·68 per 1,000), though, to some extent, this is accounted for by the fact that 8 out of the 38 prisoners who died at this period of residence were over 50 years of age.

Burma.

The health of the jail population of Burma during 1895 was, on the whole, satisfactory, and the death-rate was the lowest of which there is any record. Among all classes of prisoners the admissions into hospital were in the ratio of 892 per 1,000, against 876 in 1894, the daily sick-rate was 38 or 5 per 1,000 less, and the death-rate was only 17·93 as compared with 28·78 It will also be observed that the Burma jail death-rate for 1895 was the lowest of all jails under local governments and administrations. Apparently no " special measures were taken to obtain this satisfactory result, and it " must be concluded that the low rate of mortality was in consequence of an intelligent " and strict attention to all the ordinary details of jail management." To some extent the greater healthiness of prisoners in this province is accounted for by the people being " on the whole more healthy and better nourished than those in some of the " provinces of India." Of the 245 deaths which occurred during the year, 23 were due to fever, 56 to dysentery and diarrhœa, and 16 to cholera—seven of which took place at Sandoway, and four each at Minbu and Myingyan. The jails of the province continued to enjoy complete immunity from small-pox. Seven of the jails recorded a higher death-rate than the average, the highest being Sandoway, 200 per 1,000; Akyab, 79·23; Pagan, 47·06; and Minbu, 33·9; but the number of prisoners in these jails, except Akyab, is small, and a few deaths give a high rate. In Sandoway the average daily strength was only 35, and in Minbu 118, and the seven deaths in the former and the four in the latter—all due to cholera—accounted for their high death-rates. All but 18 of the total 245 deaths occurred amongst convicts, their death-rate being 17·17 per 1,000, against 28·50 in 1894. It is reported that all the jails except five were more or less overcrowded during the year, and that it was necessary to occupy verandahs and work-sheds as dormitories.

Central Provinces.

The health of the prisoners in the jails of the Central Provinces during 1895 was most unsatisfactory. The admissions into hospital per 1,000 of average strength fell from 951 in 1894 to 922, but the daily average sick-rate rose from 34 to 35 per 1,000, and the death-rate from 31·74 to 55·96, the highest mortality since 1887. It will be observed that the death-rate was out of all proportion to the increase in the sick-rate, denoting, apparently, greater severity in the sickness from which the prisoners suffered. Out of the total number of 277 deaths, more than half (149) were caused by dysentery and diarrhœa, chiefly by a highly fatal and malignant form of the former disease. The new admissions into jail were generally in poor health and low condition, and many of them were admitted at once either into the infirm gang, or into hospital. Almost all the jails recorded a higher mortality as compared with the previous year. Those of Balaghat, Narsinghpur, Seoni, Saugor, Mandla, and Hoshangabad furnished the highest figures, their ratios ranging from 378·5 to 162·5 per 1,000. Among other diseases respiratory diseases caused 36 deaths, fevers 14, and cholera 15. In the previous year there were only two fatal cases of cholera. All but nine of the 277 deaths occurred amongst convicts, the death-rate being 57·65, against 32·36 in 1894.

Assam.

The health of the prison population of Assam in 1895 was not so good a in 1894. The rate of admissions to hospital was somewhat lower than in the previous year, 1,287 per 1,000 against 1,411, but the daily sick-rate rose from 56 to 58, and the death-rate from 51·65 to 59·21. The cause of this high mortality was specially inquired into by the Chief Commissioner, who came to the conclusion that it was due chiefly to the absence of proper supervision over convicts employed extra-murally. Orders were issued for placing the whole system of extra-mural labour on a more satisfactory footing. Of the total 85 deaths among all classes of prisoners, 36 were due to dysentery and diarrhœa, and 11 to intermittent fever. There was only one death from cholera. All but four of the deaths occurred amongst convicts, the death-rate being 61·68 against 53·38 in 1894. Excluding the lock-ups, the average death-rate of the nine jails in the province

was 69·02 per 1,000, as compared with 58·73; but only three, Silchar, Gauhati, and Sylhet, were responsible for the increase, every other jail showing a decrease. The mortality in Silchar, although showing an increase, was not high, but Sylhet returned a death-rate of 81·47 as compared with 45·33 in 1894, and Gauhati 56 91 against 49·68. To some extent the high mortality of Gauhati jail was due to the transfer to it of sickly prisoners from Tezpur.

Madras. There was more sickness among the prisoners in the Madras Presidency in 1895 than in the previous year, but the mortality was lower. The hospital admission rate rose from 628 per 1,000 of average strength to 643, the daily sick-rate was 26, or 1 per 1,000 more, while the death-rate declined from 19·85 to 18·18, being a lower mortality than that of any previous year since 1886. The Inspector-General ascribes the low death-rate to the attention given to the proper feeding of the prisoners, and he states that the cause of undue sickness in jails is neglect in "proper selection, preparation, and "distribution of food to the prisoners. That this is in practice the most important "factor in determining the health of prisoners in jails in this country I am more and more "convinced, and it is evident that the care devoted to the food can never be relaxed, "for while conservancy, drainage, ventilation, and even water-supply, when once "properly settled need not alter, the cooking and distribution of the food may vary "from day to day." The average death-rate of the central jails was again satisfactory, 16·5 per 1,000, and it would have been lower but for the high mortality of the Cuddapah jail, whose death-rate was 50·81. The most unhealthy jail was Parvatipuram, which recorded a death-rate of 123·60 per 1,000. Owing to the persistent unhealthiness of these two jails they were ordered to be temporarily closed during the year. Russelkonda returned the next highest death-rate (44·52), resulting from three deaths among an average strength of 70. Of the remaining 24 jails the mortality ranged from 27·04 to 5·05 in 17, while in seven there were no deaths. Dysentery and diarrhœa and respiratory diseases were the chief causes of mortality among the prisoners, the deaths from the former numbering 56, and from the latter 27, out of a total of 178. From cholera there were eleven deaths, but only in Palamcottah Jail did the disease assume an epidemic form, the number of cases being six of which five proved fatal. The increased sickness of the year was occasioned almost entirely by the great advance among convicts in the admissions from fever, viz., from 190 per 1,000 of strength in 1894 to 251 in 1895. Of the total 178 deaths convicts contributed 165, representing a ratio of 19·26 per 1,000 of average strength as compared with 20·69 in 1894.

Bombay. The general health of the prison population of the Bombay Presidency during 1895 was less satisfactory than in the previous year, though there was a slight fall in the mortality. The rate of admissions to hospital per 1,000 of average strength rose from 810 to 956. The daily sick-rate (30) was 1 per 1,000 more, while the death-rate declined from 32·07 to 29·23 per 1,000. Among the convicts the mortality was 32·2 or only 1 per 1,000 less than in 1894. Eight out of the 18 jails were overcrowded throughout the year, and of these eight three, the Common Prison, Bombay, and the jails of Ahmedabad and Thana, recorded convict death-rates of 42·8, 51·7, and 55·8 per 1,000 respectively. In the Deccan Gang also the mortality (51·0) was considerably above the average. In none of the jails, however, was the mortality nearly so high as the average death-rates formerly recorded for the jails, now closed, at Ahmedabad, Kaira, and Dhuliakot. All but 22 of the total 245 deaths (including 12 in the lock-ups) occurred among the convicts, the chief causes of mortality being, dysentery and diarrhœa 71, respiratory diseases 60, including 51 from pneumonia, fevers 14, phthisis pulmonalis 18, anæmia and general debility 8, and cholera 5. All the cholera deaths occurred in the Deccan Gang and formed a third of its mortality. "Prompt measures," the Inspector-General reports, "were taken in the shape of "stoppage of work, shifting of camp, boiling drinking water, &c., to check the "disease. The cause of the outbreak could not be clearly traced, but as cholera "was prevalent in a neighbouring village it may be assumed that the disease found "its way thence to the Gang camp, although communication between the camp "and the village in question had been prohibited." Pneumonia, as usual, was very prevalent in the Sind jails, 71 cases, or nearly half the total number, having occurred in them. Twenty-nine of the 71 cases took place in Ahmedabad Jail and 20 in Yerrowda, results which call for special measures "for further improvements in the "matter of bedding and clothing for the prisoners."

Berar. The vital statistics of the jails in Berar show that the general health of the prisoners was far better in 1895 than in the previous year. The rate of admissions into hospital

per 1,000 of average strength declined from 1,327 to 877; the daily sick-rate also fell from 49 to 23 and the death-rate from 28·56 to 23·26. Of the six jails in the province the mortality was highest (38·63) in Akola, while in Amraoti, which in respect of population and surroundings was somewhat similar to the jail at Akola, it was lowest, (15·14). Of the total 33 deaths 20 occurred in the Akola Jail, and of these five were due to respiratory diseases, four to dysentery and diarrhœa, three to anæmia and general debility, and three to scurvy. Ten out of the 20 deaths in this jail were among prisoners above 55 years of age. All but one of the 33 deaths occurred amongst convicts, their death-rate being 25·64 per 1,000 as compared with 29·13 in 1894.

V.—VACCINATION.

General results.

During 1895–6 there were 7,223,591 persons successfully vaccinated in the several provinces of India, being an increase of 356,320 on the number of the previous year. According to age, $2\frac{3}{4}$ millions (2,741,708) of the total were children under one year of age, and over $3\frac{1}{4}$ millions (3,369,313) were children between the ages of one and six years. The proportion of population protected against small-pox by the year's operations ranged from 58·52 in Coorg and 42·20 in Assam to 28·49 in the North-Western Provinces and Oudh. In the vaccination of infants the best results were, as usual, obtained in the Punjab, Berar, and Bombay, where 58·8, 58·2 and 58·0 per cent. respectively of the children born during the year (estimated at 40 per 1,000 of population) were protected against small-pox. In the Central Provinces the percentage was nearly 50, and in the remainder it ranged from 30·2 in the North-Western Provinces and Oudh to 17·2 in Coorg, and 14·7 in Bengal.

Statement showing the total number of persons successfully vaccinated during the year 1895–96 :—

Province.	Population among whom Vaccination was carried on (Census of 1891).	Number of Persons successfully vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Children born during the Year (calculated at 40 per 1,000 of Population) successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal - - -	70,761,383	2,200,472	31·09	416,307	1,477,096	14·7
North-Western Provinces and Oudh.	47,146,033	1,343,207	28·49	570,227	614,949	30·2
Punjab - - -	20,724,940	775,972	37·44	487,217	153,692	58·8
Central Provinces - -	12,172,345	438,164	35·99	239,865	121,503	49·3
Berar - - -	2,897,040	92,177	31·81	67,439	19,200	58·2
Burma - - -	8,146,855	321,918	39·39	71,848	162,265	22·0
Assam - - -	5,634,258	237,769	42·20	47,176	131,507	20·9
Madras Presidency - -	35,651,577	1,080,613	30·31	314,117	543,321	22·0
Bombay Presidency - -	22,701,942	723,172	31·85	526,324	141,737	58·0
Coorg - - -	173,055	10,127	58·52	1,188	4,043	17·2
TOTAL - -	226,010,428	7,223,591	31·96	2,741,708	3,369,313	30·3

Bengal.

The total number of vaccinations performed in Bengal during 1895–96 was 2,277,081, of which 2,200,472 were successful, against corresponding figures in 1894–95 of 2,174,097 and 2,089,823. The primary operations numbered 2,227,932, of which 97·84 were successful. According to age, 416,307 of the successful primary vaccinations were of children under one year of age, and 1,477,096 were between one and six years. For the whole province the successful vaccinations were in the proportion of 31·09 per 1,000 of the population against 27·98 in 1894. The death-rate from small-pox was, in 1895, 0·18 per 1,000 as compared with 0·11 in the previous year. Estimating the births during the year at 40 per 1,000, the percentage of infants successfully vaccinated was only 14·7, a ratio far below that attained in other provinces. There was, however, a slight improvement in the protection afforded to infants as compared with the results of the previous year. Three methods of vaccination are practised in the province—(1) with lymph taken direct from the calf; (2) with calf lymph prepared with lanoline; (3) with human lymph taken by arm to arm transfer.

"Speaking from personal experience extending over six years in other provinces, of "all these methods of vaccination," Dr. Dyson observes, "I have no hesitation in "pronouncing very decidedly in favour of vaccination direct from the calf. I see it "stated in previous reports of this Department that lymph 'when properly procured "'by the arm-to-arm process and from healthy children, is of equal value to the "'lymph procured direct from calves.' I am not prepared to admit this; but "even supposing it to be the case, the difficulty is always to procure healthy "subjects . . . . The advantages of direct calf-vaccination are so great, that it "is fast gaining a strong foothold in the public estimation. Three years ago when "I was officiating as Sanitary Commissioner of these provinces, and suggested this "idea for mufassal towns and rural areas, there was immediately a storm of opposition;

" religious prejudices were put forward, and the impossibility of inducing the people " to give up their calves temporarily was said to be insuperable. Judicious " perseverance, however, in some places, in accordance with my expressed conviction " that it would succeed, has gained the day, and I now find on returning to Bengal " that there is scarcely any prejudice in the northern, eastern and lower districts of " the province." As regards the attitude of the people, Dr. Dyson reports that the people seem to be gradually realising the benefits of vaccination, but that there are still places where vaccination is opposed chiefly on sentimental grounds. A considerable step in advance has been made in Faridpur by Dr. Deare, Deputy Sanitary Commissioner, who induced 36,240 Ferazi Muhammadans, including the leaders of the community, to submit to vaccination with lanoline lymph.

North-Western Provinces and Oudh.

Vaccination continued to make steady progress in the North-Western Provinces and Oudh. The total number of persons vaccinated rose from 1,423,703 in 1894–95 to 1,499,253 in 1895–96, and the successfully vaccinated from 1,264,841 to 1,343,207. The proportion of persons protected by vaccination is, however, still very small, the ratio for the year being only 28·49 per 1,000, which is the smallest ratio attained in any province in India. The mortality from small-pox was in the ratio of 0·04 per 1,000 against 0·09 in 1894. Primary vaccinations numbered 1,437,790, of which 90·89 per cent. were successful. Of the 1,305,919 successful primary cases 570,227 were infants and 614,949 were children over one and under six years of age, both figures showing a satisfactory improvement as compared with the numbers of the previous year, which were 562,481 and 574,426 respectively. Estimating the births at 40 per 1,000 of the population, 30·2 per cent. were successfully vaccinated during the year. But, including the figures for children between one and six years, which show that the arrears of unprotected children remaining at one year of age have been largely overtaken within the next five years, the successful primary vaccinations equalled 79·76 per cent. of the births, a " closer approximation to the birth-rate than has ever before been attained."

In previous years the areas of operation had been divided for the purposes of control into three circles, each in charge of a Commissioned Medical Officer, acting as Superintendent of Vaccination and Deputy Sanitary Commissioner. From the 1st February 1896 the number of these officers has been reduced to two, and the areas of control have been re-arranged.

In the first circle, where in some districts vaccination for years past has been more fully established than elsewhere in the province, the average ratio of success of its 27 districts equalled 31·63 per 1,000 of the population, against a mean for the five previous years of 25·29. In the second circle, the average ratio of its 22 districts was 25·74 against a five years' mean of 18·84. The Vaccination Act is in force in all the municipalities, but Dr. Hutcheson says it is not worked as efficiently as it should be. The results, however, show an improvement on the previous year, the ratio of successful vaccinations per 1,000 of population having risen from 34·92 to 38·15.

Punjab.

Vaccination continued to be satisfactorily performed in the Punjab. Altogether there were 923,175 operations performed during 1895–96, showing an increase of 20,320 cases as compared with the results of the previous year. The increase was entirely among primary cases, for the number of re-vaccinations (229,431) was less by 20,771. Of the primary cases, 93·10 per cent. were successful. The number of successful cases among children under one year of age rose from 472,307 or 57·4 per cent. of the births, calculated at 40 per 1,000 of population, to 487,217 or 58·8 per cent. The provincial ratio of persons successfully vaccinated per 1,000 of the total population was 37·44, against 35·48 in the previous year. From small-pox the death-rate for the year was 0·41 against 0·30 in 1894. Buffalo lymph was chiefly used, and during the year 93 per cent. of the vaccinations were performed with it. The difficulty, however, in procuring buffalo calves increases every year, and if animal vaccination is to be continued, the Sanitary Commissioner says, steps must be taken to meet it. He believes, however, that the difficulty can be overcome by substituting preserved for fresh lymph, experiments made during the year having shown that lymph preserved in vaseline has many advantages over fresh lymph. High caste Hindus willingly permit their children to be vaccinated from it, and thus it may fairly be said we have succeeded in overcoming in great measure the caste prejudices of the people against these operations.

Burma.

Good progress was again made in the extension of vaccination in Lower Burma during 1895–96. The total number of persons vaccinated was 245,065, as compared

with 208,060 in the previous year. The increase of 37,005 was contributed by 11 of the 20 districts, but chiefly by Prome, where the excess amounted to over 10,000 operations. The percentage of success in primary operations continued to improve. Out of 216,759 primary cases, 91·22 per cent. were successful, against a corresponding ratio of 90·96 in the previous year. The number of infants protected was 41,107, equal to about 22 per cent. of the births, estimated at 40 per 1,000 of the population. The total successful vaccinations per 1,000 of population were in the ratio of 39·39 as compared with 33·37 in 1894. The death-rate from small-pox declined from 0.38 to 0·34.

At the end of the year the Vaccination Act was in force in all but four of the 27 municipalities, most of them having voluntarily applied for its extension. Its benefits are less appreciated in rural tracts, because its efficacy is not so well understood; but the large increase in the number of operations within the last four years—the successful primary cases having nearly doubled—is a sign "that the popular "distrust, such as it is, is being gradually overcome."

In Upper Burma 120,678 vaccinations were performed during 1895–96, being an increase of 858 on the number of the previous year. But though the increase was small the quality of the work showed a great improvement, the percentage of success in primary vaccinations having risen from 88·97 in the previous year to 92·63. Estimating the births at 40 per 1,000 of population 22·0 per cent. were successfully vaccinated, practically the same as in 1894–95. The Vaccination Act was extended to four municipalities and four cantonments during the year. In the province of Burma as a whole the ratio of successful vaccinations per 1,000 of population was 39·39, as compared with 33·37 in the previous year, and the percentage of infants successfully vaccinated, estimating the births at 40 per 1,000 of population, was 22·0, an increase of 5 per cent. on 1894–95.

Central Provinces.

In the Central Provinces there were 465,475 persons vaccinated during 1895–96, showing a decrease of 23,790 on the number of the previous year. Primary vaccinations fell from 432,280 to 397,261. The percentage of success in primary cases was 96·22, against 96·27, and the proportion of the total population protected by vaccination was 35·99, as compared with 36·58 in 1894–95. As previously stated, the mortality from small-pox was unusually high, 0·70 per 1,000 against 0·16 in 1894. Of the 18 districts in the province 15 showed a decrease in primary operations, and three an increase. Vaccination from the calf continued to make steady progress, and in some districts had almost superseded the use of humanised lymph. In the protection of infants there was also a falling off, the number vaccinated under one year of age during the year having decreased from 262,916 to 239,865. No additional municipalities were brought under the Vaccination Act during the year, the number remaining at 25.

A new arrangement for the supply of lymph was initiated and carried out during the season with entire success. Instead of organising, as had been previously the custom, a manufacture of lanoline paste from the product of buffalo calves, each Civil Surgeon now produces at his head-quarter station a sufficient supply of calf lymph with which to provide his vaccination establishment at the commencement of the working season. A supply of calf lymph sent out from England was distributed, but, except in one case, it proved inert. With the lymph obtained from calves, 283,759 vaccinations were performed during the year, and 264,834 were successful.

Assam.

The results of vaccination work in Assam for 1895–96 compare favourably with those of the previous year. There were 260,690 operations performed by all agencies in the province, which is an increase of 60,553 over the figures of 1894–95. All the plains districts contributed to the increase, but there was a falling off in the hill districts, especially in the Naga Hills. The largest increase occurred in the Sylhet district (24,182), followed by Sibsagar (11,423). In the Manipur State also there was an increase of 5,633, which is highly satisfactory, as the State has at times suffered very severely from small-pox. Of the total operations 253,641 were primary cases, and of these 96·9 per cent. were successful, this high rate being attributed to the improvement in the lymph supplied from the Shillong Bovine Lymph Depôt. The Compulsory Vaccination Act was extended during the year to the station of Shillong, and Act XIII was at the same time brought into force in the cantonment of Shillong. With these additions there are ten places under the Acts, their population being 68,847. The number of infants successfully vaccinated was 47,176, representing only 20·9 per cent. of the births, estimated at 40 per 1,000 of the population. The ratio of persons protected by vaccination per 1,000 of population was 42·20 against 28·09 in the previous year; the death-rate from small-pox declined from 0·80 to 0·77 per 1,000.

The aggregate number of vaccinations performed in the Madras Presidency during 1895–96 was 1,198,171, being a decrease of 751 on the operations of the previous year. Of the total, 1,120,625 were primary cases, of which 91·22 per cent. were successful, against 91·60 per cent. in 1894–95. The number of children under one year of age successfully vaccinated rose from 297,723 to 314,117, which represented only 22·0 per cent. of the estimated births, as compared with 20·8 per cent. in the previous year. Vaccination was compulsory in all municipalities, and the number of operations performed by municipal vaccinators rose from 118,135 to 120,190. In the town of Madras there was an increase in the number of operations performed, from 24,725 to 27,024. Of the 21 districts there was a decrease of work in 10, the most marked case being that of Vizagapatam (12,207); the remaining 11 districts showed an improvement, the largest increase being 9,034 in Coimbatore. Animal vaccine was employed both in districts and municipalities, and the total number of vaccinations performed with it was 1,190,541, or only 7,630 less than the total number of operations, and of these 1,074,919, or 92·3 per cent. were successful, the corresponding figures for the previous year being 1,164,150, 1,053,993, and 92·5 respectively. The best results were obtained, as usual, from calf-to-arm vaccination, with a percentage of success of 97·3. The ratio of successful vaccinations per 1,000 of population was 30·31 per 1,000 against 29·7 in 1894; the death-rate from small-pox was only 0·1 per 1,000 as compared with 0·3. Madras.

Omitting the statistics of five Native States which are not under the supervision of the Bombay Vaccination Department the out-turn of vaccination work in the Presidency rose from 773,526 operations in 1894–95 to 810,804 in 1895–96. This gives an increase of 37,278, of which 20,292 occurred in primary vaccination, and 16,986 in re-vaccinations. The total primary cases rose from 712,356 to 732,448; the percentages of success being respectively 93·48 and 93·23. The substitution of animal for human lymph continued to increase in the Presidency. It is satisfactory to learn that this mode of vaccination is appreciated. In the City of Bombay vaccination with animal lymph exclusively was carried on throughout the year. Of the 683,044 primary successful cases, 72 per cent. were infants under one year of age, and reckoning the births at 40 per 1,000 of population, 58 per cent. were protected from small-pox. Inoculation was not practised anywhere in the Presidency during the year, except in the Dangs. The successful vaccinations per 1,000 of population rose from 30·68 in the previous year to 31·85; the death-rate from small-pox fell from 0·17 per 1,000 to 0·12. Bombay.

There was a still further falling off in the out-turn of vaccination work in Berar during 1895–96, the total operations having decreased from 114,639 in 1894–95 to 106,605. The number of primary vaccinations was 92,694, out of which 95·92 per cent. were successful, against 93,296 and a rate of success of 94·67 in 1894–95. The decrease of 602 primary, and 7,432 re-vaccinations was attributed to the unhealthiness of the two preceding seasons, as shown by the death-rates of 42·0 in 1894 and 49·9 in 1895. Influenza being very prevalent throughout the province there was also much sickness among the general population as well as amongst the vaccinators. "In sickly years," the Sanitary Commissioner writes, "the infantile population being most susceptible "suffers most, consequently there are fewer children available for vaccination, and "this is a fact which must be taken into consideration when measuring the work of "any one year with another; for, as has been pointed out in previous reports, primary "operations, considering the proportion of the population already protected, must of "necessity fluctuate with the number of infants available for operation." Of the total number of successful primary operations, 67,439 were performed on infants under one year of age; estimating the births at 40 per 1,000 of population, 58·2 per cent. were protected from small-pox. The Sanitary Commissioner furnishes a statement showing the efficacy of vaccination in checking small-pox mortality in Berar; the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of five years 1868–69 to 1872–73, to 35·8, the mean of five years ending 1892–93; the mortality from small-pox for the same periods has declined from 2·02 to 0·2 per 1,000. The corresponding ratios for 1893–94 were 35·0 and 0·06 per 1,000, those for 1894–95 were 32·2 and 0·37, and for 1895–96 the ratios were 31·8 and 0·2 respectively. The proportion of the population successfully vaccinated was 31·81 per 1,000, against 32·19 in the previous year. The Vaccination Act is in force in all the municipal towns except Karinja, and is reported to be working satisfactorily. Berar.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1895 and the previous year, and the number of patients under treatment:—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1895	427	45,243	2,434,536	2,479,779
	1894	383	43,824	2,241,626	2,285,450
Calcutta and Howrah	1895	12	26,879	266,672	293,551
	1894	12	24,912	264,041	288,953
North-Western Provinces and Oudh	1895	340	61,514	3,955,681	4,017,195
	1894	336	59,366	3,882,395	3,941,761
Punjab	1895	257	56,172	3,204,445	3,260,617
	1894	255	56,254	3,423,669	3,479,923
Burma	1895	93	30,607	602,380	632,987
	1894	88	28,864	542,061	570,925
Central Provinces	1895	117	12,224	1,249,366	1,261,590
	1894	117	10,872	1,191,625	1,202,497
Assam	1895	97	5,987	538,951	544,938
	1894	93	5,575	498,409	503,984
Coorg	1895	7	1,343	36,859	38,202
	1894	7	1,152	33,919	35,071
Madras	1895	498	55,767	3,977,114	4,032,881
	1894	479	55,817	3,775,830	3,831,647
Bombay	1895	317	47,686	2,442,330	2,490,016
	1894	307	48,824	2,389,685	2,438,509
Berar	1895	46	4,912	346,443	351,355
	1894	46	4,804	344,778	349,582
TOTAL	1895	2,211	348,334	19,054,777	19,403,111
	1894	2,123	340,264	18,588,038	18,928,302

Bengal.

The returns of the charitable dispensaries in Bengal for 1895 show a still further increase both in the number of institutions and in the number of patients under treatment in them. The total number of dispensaries at work during 1895 in Bengal, exclusive of the medical institutions at Calcutta, was 427, an increase of 44 on the number of the previous year. At these there were 2,479,779 patients under treatment, 45,243 being in-door and 2,434,536 out-door patients, against 43,824 and 2,241,626 respectively in the previous year. This shows a total increase of 194,329, which was attributed partly to the opening of new dispensaries and partly to the increasing popularity of the institutions. These figures, however, fall short of those for the North-Western Provinces and the Punjab, though Bengal has more dispensaries than any of the other provinces. "One of the chief causes of low attendance in Bengal," the Inspector General observes, "is the large number of private practitioners and "druggists' shops which exist in all parts of the province. Anyone with a smattering "of medical knowledge, and even without it, can and does set up as a private "practitioner. There is absolutely no prohibition in this respect, and I believe there "is actually a so-called Medical School in Calcutta which grants medical diplomas, "although it has no charter and is not even affiliated to the University or to any "recognised medical institution. The result is a flood of ignorant indigent practi-"tioners let loose amongst a prosperous population. This in itself is sufficient to

" account for a low attendance at the dispensaries." There was again a satisfactory increase in the number both of women and children, but the number of males was nearly four times that of females. The increase among women, though not so great as in the previous year, amounted to 36,362 or 10 per cent., the number having risen from 362,632 to 398,994. Of the diseases under treatment at the dispensaries, cholera, dysentery, and malarial fevers were responsible as usual for the largest number of cases. From malarial fever the cases rose from 473,362 in 1894 to 525,300, equal to 21 per cent. of the total number of patients; but cases of dysentery decreased from 87,243 to 59,757, and the number of cholera patients from 12,181 to 11,497. Cases of venereal diseases rose from 55,818 to 57,008. Among in-door patients the deaths rose from 5,051 or 115·2 per 1,000 of total treated in 1894 to 5,568 or 123·1 in 1895. Great attention is paid in these institutions to surgery, and during the year 13,026 major operations were performed against 10,912 in 1894; including those remaining from the previous year, the total number was 13,334, and of these 201 terminated fatally. Operations for cataract increased from 2,323 to 2,861, and of these more than 80 per cent. proved successful.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta during 1895 and the previous year:—

Name of Institutions.	1895.				1894.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	6,951	58,441	65,392	107·7	7,044	57,906	64,950	102·6
Presidency General Hospital	3,124	519	3,643	53·4	3,031	303	3,334	48·1
Campbell Hospital	9,186	26,303	35,489	245·5	8,440	25,176	33,616	237·0
Police Hospital	2,982	—	2,982	6·7	2,305	—	2,305	10·4
Mayo Native Hospital	2,000	31,431	33,431	93·0	1,856	29,974	31,830	115·3
Chandney Hospital	367	45,309	45,676	57·2	338	44,762	45,100	38·4
Park Street Dispensary	—	30,158	30,158	—	—	31,977	31,977	—
Chitpore Dispensary	—	24,908	24,908	—	—	23,403	23,403	—
Sukea's Street Dispensary	—	18,574	18,574	—	—	19,686	19,686	—
Dufferin Victoria Hospital	520	8,315	8,835	7·6	304	10,706	10,706	13·1
Bhawanipur Dispensary	—	11,023	11,023	—	—	9,035	9,339	—
Total Calcutta Hospitals and Dispensaries	25,130	254,981	280,111	135·9	23,318	252,928	276,246	134·9
Howrah General Hospital	1,749	11,691	13,440	245·2	1,594	11,113	12,707	225·2
Grand Total	26,879	266,672	293,551	143·2	24,912	264,041	288,953	140·8

The figures for 1895 show an increase of 2,631 in out-door patients, and of 1,967 in in-door patients. The increase in the former was attributed partly to improved accommodation in the Medical College Hospital, and partly to the growing popularity of the out-door departments of the several institutions. The death-rate among the in-patients was 143·2 per 1,000 against 140·8 in 1894. Cholera patients rose from 567 to 600, and the fatal cases from 323 to 349. There was a great epidemic of small-pox during the year and the cases rose from 177 to 765, and of these 279 terminated fatally. Dysentery and diarrhœa were not so prevalent, and the number of patients fell from 17,838 to 16,689. The number of cases of malarial fever rose from 53,785 to 59,256. Venereal diseases show an increase of 255 patients, the number treated having risen from 13,419 in the previous year to 13,674. There were 3,775 important surgical operations performed against 3,643 in 1894, and of these death ensued in 124 cases against 129.

North-Western Provinces and Oudh.

During 1895 five new dispensaries were opened and one was closed in the North-Western Provinces and Oudh, bringing the total at the end of the year up to 340. The number of patients who received medical aid was 4,017,195 against 3,941,761 in the previous year. There was thus an increase in 1895 of 75,434 patients. Of these 14,144 were treated in the newly opened dispensaries, leaving an actual increase of 61,290 cases or 1·5 per cent. to the credit of those previously established. Notwithstanding this testimony to the growing popularity of hospitals and dispensaries in the province, the conclusion that ignorant prejudices still militated against the complete utilisation of medical relief is shown by the fact that Hindus though constituting 86 per cent. of the inhabitants continued to resort to it in only twice the number of

Mussulmans. Of the total number 774,180 were women, and 1,064,524 were children, both showing a marked increase on the figures of the previous year, which were 755,353 and 1,035,065 respectively. The in-door patients numbered 61,514 as compared with 59,366 in 1894, and among them there were 3,502 deaths, giving a death-rate of 56·9 per 1,000 against 3,469 or 58·4 in the previous year. Of the diseases for which the patients were treated 683,136 were suffering from malarial fevers, a decrease of 3,926 on the number of 1894; cases of cholera declined from 11,255 to 2,743, and cases of diseases of the eye increased from 307,025 to 319,838. From venereal diseases there were 78,640 patients against 77,368 in the previous year. The progress of surgical work kept pace with the general increase in the number of patients applying for relief. The number of surgical cases rose from 182,349 to 192,582. These included 30,633 major operations (with 1,026 remaining from the previous year), of which 24,340 resulted in cure and 436 were fatal. Of the 30,633 major operations 10,565 were for cataract, of which 84 per cent. were successful, as compared with 9,222 operations and a percentage of success of 84·8 in 1894.

Punjab. Two more dispensaries were at work in the Punjab during 1895 than in the previous year, bringing the total number of these institutions up to 257. At these, 3,260,617 patients were under treatment, being a decrease of 219,306 on the number of 1894. The decrease, however, was chiefly among out-patients, the number of in-patients (56,172) being practically the same as in the previous year (56,254). The year was much more healthy than the previous one, and this is the main cause of the smaller number of applicants for advice and treatment. Of the diseases for which patients sought relief there were only 21 cases of cholera, being a decrease of 29 on 1894. Cases of malarial fever fell from 629,853 to 438,166. Diseases of the eye showed a decrease of 33,303 cases, the number treated in 1895 being 355,819 against 322,516. From venereal diseases there were 33,836 cases under treatment, a decrease of 4,995 on the previous year's figures. Among the in-patients there were 2,431 deaths during the year, being in the ratio of 43·3 per 1,000 of the number treated against a death-rate of 44·0 in 1894. In surgical work minor operations decreased from 216,730 to 214,655, and those of a major kind increased from 19,812 to 20,094. Including those remaining from 1894, the latter numbered 20,468. Among these there were 6,335 cases of extraction of the lens, including 119 remaining under treatment from the previous year, of which 87·8 per cent. resulted in cure.

Burma. Two new dispensaries were established in Lower Burma during 1895, bringing the total up to 43. At these 396,458 patients attended, as compared with 355,897 in 1894. In-door patients rose from 18,812 to 20,675, of whom 15,522 were cured, and 1,271 or 60 per 1,000 died, against 1,612 deaths or 90 per 1,000 in the previous year. The total number of Burmans treated was 211,551, exceeding the number of 1894 by 33,276, and there was an improvement in the attendance of the other classes also. Malarial fevers were again responsible for over one-fifth of the attendance. Small-pox cases rose from 143 to 197; while, on the other hand, cholera cases fell from 594 to 213. Surgical work also showed an increase both in major and minor operations, the former having risen from 699 to 808, and the latter from 9,513 to 10,159. The number of patients cured, after being subject to major operation, was 690, and the deaths numbered 22.

In Upper Burma 50 dispensaries were working in 1895, or three more than in the previous year. The total number of patients under treatment was 236,529, of whom 9,932 were in-patients, the corresponding figures for 1894 being 215,028 and 10,052 respectively. In the course of the year 8,052 patients were cured, 624 relieved, 272 discharged otherwise, and 518 died, the deaths yielding a ratio of 50 per 1,000, against 60 in 1894. The Burmese resort to these institutions in greater proportion than in Lower Burma, the percentage of Burmese to total treated being 53·4 per cent. for the lower part of the Province against 62 per cent. in the upper part.

Central Provinces. There was no change in the number of hospitals and dispensaries at work in the Central Provinces during 1895, it remained at 117. The total number of patients rose from 1,202,497 to 1,261,590. The increase extended to both in and out door patients, the former having risen from 10,872 to 12,224, and the latter from 1,191,625 to 1,249,366. Among the in-patients there were 1,321 deaths, or 113·8 per 1,000 of total treated, an increase of nearly 20 per 1,000 on the mortality of 1894, which was "caused by the admission of destitute paupers, very frequently in a moribund condition." As regards the different kinds of diseases treated the statistics do not

exhibit many features that call for notice. Malarial fever, ulcers, and diseases of the eye and skin were responsible, as usual, for the largest number of cases treated. There were 31,416 surgical operations performed against 29,311 in 1894. Of these, 3,593 were major against 3,260. There has been a marked increase in purely surgical work during the last two years. In 1894 the increase of major operations was 55 per cent. in excess of the number in the preceding year, and in 1895 the annual increase was over 10 per cent. In the operations for cataract there has been a considerable increase, viz., from 479 in 1893 and 949 in 1894 to 1,299 in 1895.

Assam.

In the province of Assam there were 97 dispensaries open during 1895, at which 544,938 patients were under treatment against 503,984 in the previous year. The in-patients numbered 5,987, as compared with 5,757 in 1894, and of these 2,935 were cured, 575 relieved, 1,137 discharged otherwise, and 1,127 died, the latter representing 188·2 per 1,000 of the total in-patients, against a ratio of 180·1 in 1894. The increase of 40,954 in the number of patients treated was attributed to the growing popularity of these institutions. It is satisfactory to note that there was a slight increase of 107 among the indigenous population who resorted to the dispensaries as in-door patients, the number having risen from 1,526 to 1,633. The progress made within the past decade in the extension of the system of bringing medical relief to the poor of Assam by means of dispensaries may be gathered from the fact that the number of these institutions has increased from 46 to 97 and the total number of patients from 149,051 to 544,938, or by more than 265 per cent. Of the total number of persons who received medical aid, malarial fever, including kala-azar, accounted for 120,255 cases, or nearly a fifth of the total treated; skin diseases 127,836, worms 78,722, dysentery and diarrhœa 28,462, and diseases of the digestive system 26,524. Cholera patients numbered 1,786, against 1,418 in 1894. Of surgical cases there were 12,349, including 1,126 major operations; of the latter, 978 resulted in cure, and 41 were fatal.

Madras.

Exclusive of the hospitals in the Presidency town there were 486 dispensaries working in Madras at the close of 1895, or 13 more than in 1894. The results of the year were again satisfactory, showing that 3,839,354 patients were under treatment as compared with 3,735,269 in 1894. There was thus an increase of 104,085. Of the 38,422 in-door patients, 23,484 were returned as having recovered fully under treatment, 7,486 as relieved, and 3,474 as otherwise discharged. The deaths numbered 2,265, representing a ratio of 58·9 per 1,000 of the total in-patients against 65·7 in the previous year. The largest number of admissions was from skin diseases, of which there were 450,897 cases; ulcers came next with 411,381 cases, followed by malarial fevers with 398,885 cases, and diseases of the eye with 344,331 cases. The surgical operations aggregated 134,380, including 7,385 of a major kind, of which latter 5,969 were cured and 208 terminated fatally. In 1894 the minor operations numbered 124,785, and the major 5,542.

In the 12 hospitals of Madras town, the number of sick treated increased from 199,305 in 1894 to 193,527 in 1895. The increase of 5,778 was entirely among out-patients as the number of in-patients fell from 19,480 to 17,345. Amongst them 8,415 cases were recorded to have been cured or perfectly recovered, 4,171 were relieved, 2,832 discharged otherwise, and 982 or 56·6 per 1,000 died, against a rate of mortality in 1894 of 57·9. Of the several diseases for which the patients were treated, malarial fever contributed 23,133 cases, followed by diseases of the digestive system and respiratory system with 18,737 and 13,948 cases respectively. From cholera there were only 57 cases, from dysentery and diarrhœa 6,045, and from venereal diseases 4,750, of which 1,378 were afforded in-door relief. The surgical work performed in 1895 compares favourably with that of the previous year, the minor operations having increased from 13,615 to 23,561, and the major operations from 3,794 to 4,154. The results of the latter showed that 2,680 cases were cured, 1,074 relieved, and 141 were fatal.

At the Madras Voluntary Venereal Hospital, which is included in the above hospitals in the city, there were 703 patients treated during 1894, an increase of 41 on the number of the previous year. The Superintendent writes: "The hospital is "well known and popular, and many of the patients come from distant districts. "There was no overcrowding during the year, the greatest number of sick on one "day being 88, while the number of beds is 100. . . . . As a rule the women "remain a long time under treatment. Those who are too sick to follow their "profession are only too willing to remain in hospital. Many have no friends and "continue in hospital till they die."

Bombay.

Excluding the 11 medical institutions in the city of Bombay, there were 306 hospitals and dispensaries working in the Presidency during 1895. At these 2,382,069 patients were under treatment, of whom 30,848 were in-door and 2,351,221 out-door patients, against 30,281 and 2,297,317 respectively in 1894. Malarial fevers as usual constituted by far the largest number of cases (434,118, or nearly 19 per cent. of the total treated), still there was a decrease of 29,187 when compared with the figures of the previous year. Next to fever, eye and skin diseases, and worms were the most common ailments. Small-pox and cholera patients were fewer, but dysentery and diarrhœa cases were more numerous; while patients suffering from venereal affections declined from 33,104 in 1894 to 31,911 in 1895. Of the in-door patients 20,890 were cured, 2,414 relieved, 2,339 discharged otherwise, and 1,543 died, the ratio of deaths to total treated being 54 per 1,000, a decrease of 3 per 1,000 on the ratio of the preceding year. The numbers of both major and minor operations performed during the year were much larger than in 1894. Apart from the 155 cases which remained under treatment from the previous year, 6,305 major operations were performed during 1895, giving a total of 6,460 or 1,173 more than in 1894. Of these 3,955 were cured, 266 relieved, and 118 proved fatal. The total number of minor operations was 107,733 as compared with 99,563 in 1894.

The total number of patients treated at the 11 civil medical institutions working in the town of Bombay during 1895 showed a decrease of 2,964, the figures being 107,947, against 110,911 in the previous year. The in-patients decreased in number from 18,543 to 16,838, and of these 10,301 were cured, 2,863 relieved, 1,111 otherwise discharged, and 1,614 died, the deaths being in the ratio of 95 per 1,000 of the in-patients, against 89 per 1,000 in 1894. As usual, local injuries, malarious fevers, eye diseases, and skin diseases were responsible for the majority of the cases. Venereal diseases contributed 5,251 cases, against 5,497. Cholera cases fell from 88 to 2, and those of dysentery from 1,825 to 1,571, but cases of diarrhœa rose from 3,245 to 3,260. Including 103 cases which had been operated on in the previous year, the total of major operations was 2,515, and of these 2,097 were cured, 129 relieved, 64 discharged otherwise, and 121 ended fatally. The minor operations numbered 31,386, as compared with 28,828 in 1894.

Berar.

There were 46 medical institutions at work in Berar during 1895. Of these eight are hospitals wholly maintained by the State. The total number of patients under treatment was 351,355, against 349,582 in 1894. In-patients numbered 4,912, of whom 4,069 were cured, and 291 died, which gives a death-rate of 59·8 per 1,000 as compared with a mortality of 244, or 50·8 per 1,000 in 1894. Malarial fevers continued to head the list of diseases from which relief was sought, but the cases fell from 90,470 in 1894 to 81,683; about a fourth of the total patients were treated under this head; diseases of the eye and skin came next in order. Cholera cases rose from 1,120 in 1894 to 3,366; there was also a much larger number of admissions from bowel affections. There was a falling off in surgical work; the number of major operations performed having decreased from 705 in 1894 to 630 in 1895, and of minor operations from 12,899 to 11,493.

The Dufferin Hospital for women and children at Amraoti, which was opened on the 15th February 1895, showed good results. The in-door patients during the year numbered 96, and the out-door 6,215.

Lunatic Asylums.

Bengal.

At the five asylums in Bengal (viz., Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,107 lunatics, including 184 fresh admissions and re-admissions, were under treatment in 1895, being a decrease of 9 on the number of the previous year. In the course of the year under notice 81 patients were discharged as cured, and 30 as improved or otherwise, and 75 died. Compared with the figures of 1894, the number discharged was less by 5, while the mortality was the same. At the end of the year there were 921 persons still under detention, or 2 less than at the close of 1894. The health of the inmates of the asylum was not so good as in the previous year, the average daily number of sick being 58, against 55 in 1894, and the number of admissions into hospital more numerous by 276. The death-rate, however, was slightly lower, viz., 81·5 per 1,000 of average strength, against 81·9. Exclusive of Cuttack Asylum, in which there were no deaths during the year, the average rate of mortality was made up of individual asylum rates varying between 71·5 and 97·7 per 1·000. Satisfactory progress appears to have been made in the working of dairy farms at

the asylums. From Dullunda a profit of Rs. 1,092 was reported, and the Dacca Asylum, besides affording a sufficient supply of milk to its inmates, realized Rs. 550 from the sale of milk to the public. The calves were also utilised for supplying vaccine lymph to the asylum, the jail, and the outside population. The question of amalgamating the asylums, and of forming a central asylum for all lunatics in Bengal, under the management of a specially qualified officer, was said to be under the consideration of Government. "In such an institution more attention could be given to the "systematic treatment of mental diseases than is possible under the present system, "and the Lieutenant-Governor hopes that a practicable scheme will soon be drawn "up."

In the Bhowanipur Asylum, containing European and Eurasian patients only, the inmates during 1895 numbered 54, against 64 in the previous year. Of this number 39 were under detention at the beginning of the year, and 15 were subsequently admitted, including 3 criminal lunatics. In the course of the year 10 patients were discharged cured, 2 were dispatched to Europe under the Merchant Shipping Act, 5 were transferred to the care of friends, 1 was despatched to Europe as a civil pauper lunatic, and 4 died, leaving 32 under confinement at the close of the year. The health of the patients was exceedingly good throughout the year, there were only 8 admissions to hospital, and 5 deaths. The proportion of deaths to average strength was 106·2 per 1,000, against 148·6 in 1894.

North-Western Provinces and Oudh.

The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the North-Western Provinces and Oudh in 1895, were 1,289, including 259 admissions during the year, against 1,298 in 1894. Before the close of the year 161 patients were discharged, of whom 112 were reported as cured, 49 were made over to friends, and 80 died, leaving 1,045 under treatment at the end of the year. The health of the asylum population was much better than in the preceding year, and the death-rate per 1,000 of average strength fell from 92 to 79, which was made up of ratios varying from 45 per 1,000 at Bareilly to 133 per 1,000 at Benares. Dairy farming was again very successful at Bareilly. This farm was started towards the close of 1890, with a view to reducing the danger of enteric fever and cholera among British troops by enabling them to obtain a purer supply of dairy produce. Besides giving employment to the inmates of the asylum, it has been of great use to the garrison and Civil Station of Bareilly.

Punjab.

The total number of lunatics in the Lahore and Delhi lunatic asylums in the Punjab during 1895 was 478, including 136 fresh admissions, against 480 in 1894. At the end of the year the number was reduced to 329 by the discharge of 98 patients (60 as cured, 32 made over to friends, and six otherwise discharged), and 51 deaths. The year being a fairly healthy one, there were fewer admissions into hospital, but deaths were more numerous in the Lahore Asylum than in 1894. The total number of hospital cases was 593. In Lahore the cases fell from 517 in 1894 to 492, while the deaths rose from 24, or 101·6 per 1,000 of daily average strength, to 40, or 168·0. Pneumonia was the chief cause of mortality in this asylum, and accounted for 14 deaths. In the Delhi Asylum there were 11 deaths or 98·8 per 1,000, against 18 or 171·2 in 1894. Both asylums were again entirely free from cholera in 1895. The Superintendent of the Lahore Asylum attributed the high mortality to the bad state of the barracks. The execution of improvements contemplated were deferred until a decision had been arrived at on the possibility of amalgamating the two asylums in a provincial asylum at Lahore.

Burma.

The Rangoon Asylum is the only one in the province of Burma. Until the year 1894 a number of lunatics were, for want of accommodation, confined and treated in the Rangoon central jail. The asylum has since been extended, and there is now accommodation for 350 insanes. The whole of the buildings were fully occupied, and more have since been sanctioned. During 1895 there were 437 patients in the Rangoon Asylum, including 106 fresh admissions, and the total was reduced at the close of the year to 350 by the discharge of 51 patients for different causes, and the death of 36. There was considerably less sickness among the patients than in 1894, and the admissions to hospital fell from 275 to 129. The mortality, however, was higher, the deaths having risen from 26 to 36. Of these 5 were from beri-beri, and 2 other deaths were homicidal and suicidal. The 5 deaths from beri-beri were the result of the epidemic outbreak of that disease during the last quarter of 1894. Excluding these seven deaths the mortality would be reduced from 105·4

per 1,000 to 85·0. At the close of 1895 only two lunatics were suffering from beri-beri.

Central Provinces.

In the two asylums of the Central Provinces (Nagpur and Jubbulpore) there were 381 lunatics under treatment during 1895, and of these 17 were fresh admissions. In the course of the year 34 patients were discharged as cured or otherwise, and 23 died, leaving 324 still under treatment at the commencement of 1896. The health of the patients was better than in 1894, and the admissions to hospital at Nagpur fell from 194 to 126, and at Jubbulpore from 122 to 103. Cholera was absent from both asylums. The chief cause of sickness was, as usual, malarial fever, from which there were 36 admissions at Nagpur, and 55 at Jubbulpore. At both asylums the mortality was lower as compared with the previous year. Of the total 23 deaths, Nagpur recorded 12, being in the ratio of 70·2 per 1,000 of average strength, against 13, or 80·6 in 1894. At Jubbulpore the deaths fell from 15 or 99·9 per 1,000 to 11, or 74·8. A dairy farm was started during the year at Nagpur Asylum with a fair amount of pecuniary success, for the venture cleared its expenses, and in future, now that the initial expenses have been cleared, it may be expected to yield a considerable profit, besides affording healthy and congenial employment to some of the inmates of the asylum.

Assam.

There is only one lunatic asylum in the province of Assam. This is situated in Tezpur, and the building is reported to be at present large enough for all demands on it. The total number of lunatics under treatment in the asylum during 1895 was 144, being a decrease of two on the number of the previous year. Of these 39 were fresh admissions. At the close of the year the patients in the asylum were reduced to 111, 26 of the total number having been discharged, and 7 died. Although the year was an unhealthy one in the district, there was less sickness in the asylum, and the mortality fell considerably. Among the 144 inmates 23 were admitted to hospital during the year, being in the ratio of 292·1 per 1,000 of average strength, as compared with 406·1 in 1894. The deaths fell from 28, or 264·4 per 1,000 in the previous year, to 7, or 65·9. Of these only two were received in good health, and one of them died of tetanus and the other of pneumonia.

Madras.

At the commencement of 1895 there were 623 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 221 fresh cases were admitted, bringing the total population up to 844, or 38 more than the number in the preceding year. In the course of 1895 there were 126 cases of discharge, and of these 93 were cured. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. The health of the insanes was not so good as in the previous year; the daily average sick rose from 105 to 123, and the deaths from 64, or 103·0 per 1,000 of average daily strength, to 110, or 182·5. Of the 110 deaths 94 occurred in the Madras Asylum, as compared with 56 in 1894. This great increase was due to the epidemic of cholera of the previous year, which extended to the first few weeks of the year under report, and resulted in 37 deaths. Excluding these, the deaths in this asylum are reduced to 57 or 129·4 per 1,000 of average daily strength. In Calicut there were 14 deaths, against 6 in the previous year, and of these 3 were received into the asylum in a moribund condition. Eighteen patients were admitted into this asylum suffering from tubercle of the lungs, of whom 13 died. The death-rate varied from 33·7 per 1,000 at Vizagapatam, and 135·4 at Calicut, to 213·6 at Madras.

Bombay.

The total population of the six lunatic asylums of the Bombay Presidency (Colaba, Ratnagiri, Poona, Dharwar, Ahmedabad, and Sir Cowasji Jehangir, Hyderabad) was 978, including 271 fresh admissions, against 1,000 in 1894. In the course of the year 191 patients were discharged, 80 of them as cured, and 68 died, leaving 719 under treatment at the close of the year. There was less sickness in the asylums than in 1894, the daily average sick having decreased from 48 to 45, and the death-rate fell from 138·8 per 1,000 of average strength to 94·7 Of the 68 deaths 12 were due to dysentery, 8 to epilepsy, 13 to chronic pneumonic phthisis, 8 each to epilepsy and Bright's disease, and 3 to cholera. The decrease of 33 deaths was shared in by all the asylums, but the largest decrease occurred at Poona, where the deaths fell from 32 or 336·8 per 1,000 to 18 or 210·5. The mortality at this asylum was chiefly attributable to the broken down condition of some of the lunatics on admission. All the three cholera deaths occurred at Poona, the other asylums were free from the disease.

Medical Schools.

The number of medical schools open in Bengal during 1893–94 was 12, against 9 in the previous year, the increase being due to the inclusion of three new schools in Calcutta, viz., the Electro-homœopathic School, the Bengal Eclectic Medical Institution, and the College of Physicians and Surgeons in Bengal. The Medical College, Calcutta, is affiliated to the University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the seven unaided schools (two at Dacca and five at Calcutta) follow their own standards for private practice. The total number of pupils attending the various medical schools in the province was 1,854, as compared with 1,784 in the previous year. Bengal.

The total strength of the Calcutta Medical College at the beginning of the session in 1895–96 was 511 (including 14 women), against 484 in the preceding year. As regards the examinations, 265 candidates (including seven women) were successful out of a total of 464 (including 12 women), the successes being at the rate of 57 per cent., as compared with 34 per cent. in 1894–95. The improvement in the percentage of success is considered satisfactory, "and is probably due to innovations introduced last "year, by which the students were made to see that they could be allowed to continue "their studies only by making good progress year by year." Of the 265 successful candidates, 152 (including five women) passed the Preliminary Scientific L.M.S. examination, 65 passed the first, and 28 the second L.M.S. examinations; 11 (including two women) passed the Preliminary Scientific M.B. examination; five passed the first and three the second M.B. examinations, and one as Doctor in Medicine; eight native dais passed in midwifery from the Eden Hospital, and received certificates of qualification, and 19 pupil nurses also passed as midwives.

The Campbell Medical School had 299 pupils (including 37 women) on its rolls during the session. Of this number 40 males and 4 women passed the final examination for the diploma.

At the Dacca Medical School there were 211 pupils on the rolls, 87 being in the third-year class, 71 in the second-year class, and 53 (including six women) in the first-year class. Sixty-one students of the third-year class passed the final examination, and 13 others, who failed in one subject only, were remanded for further examination after three months.

The Temple Medical School, Patna, had 159 students (including 8 women) on its rolls, a decrease of 26 compared with the previous year. At the final examination for the licence 52 candidates appeared, and 42 passed, including two women.

At the Cuttack Medical School there were altogether 163 pupils (including seven women). At the final examination for the licence 32 candidates appeared, and 26 passed, including one woman.

The number of pupils of the various classes of the Agra Medical School who attended the examination at the close of the year 1894–95 was 264 (including 51 women), as compared with 280 at the end of the preceding year. The results of the final examination of male students show that 50 out of 62 candidates passed. All but four of the 28 military students in this class passed, and 20 of the 23 civil students passed. Of the students in Class II., comprising second-year military and third year civil, private, and Rajputana pupils, one out of ten military pupils failed to pass the first half professional examination, and two out of 42 civil pupils. A rule rendering candidates ordinarily ineligible, unless recommended by the Director of Public Instruction, had, it is stated, the direct result of improving the status and qualifications of students entering the College. North-Western Provinces and Oudh.

As regards women students, the year's working shows that 49 out of the total of 51 were examined, and that 18 passed; three out of six in Class I., and 15 out of 22 in Class III. It is also reported that the social status and educational qualifications of the students annually admitted are steadily improving.

Notwithstanding the fact that Government no longer guarantees employment to the successful students in the Lahore Medical College, the numbers steadily increase year by year, and within the last seven years the class has nearly doubled. The total number of students at the Lahore Medical College and School during 1885–96 was 469, against 523 in the previous year. Of these 228 (including 2 women) were in the College Class, and 241 (including 6 women) were in the Medical Schools. The results of the year's examinations were on the whole favourable. Seventy-one candidates appeared at the first examination for the L.M.S. & M.B. degrees; of these one Punjab.

withdrew, and of the remainder 30 attained the pass standard compared with 16 out of 60 in 1894–95. At the final examination 10 out of 18 candidates passed, against 24 out of 36. One woman student passed the first examination for the L.M.S. diploma, and two were successful in the final examination. At the final examination for the Hospital Assistant Diploma, 89 candidates appeared, of whom 50 passed.

Madras. The total strength of the Madras Medical College during 1894–95 was 482, being a decrease of 97 on the attendance of the previous year. Of these 23 were women students, against 20 in 1894–95. In the Hospital Assistant Department, consisting of 218 pupils, 54 appeared for the College Diploma examination, of whom 52 passed, 11 being placed in the first class. The results of the several University examinations were again more favourable than in the previous year, 48 having passed out of 71 candidates entered, against 45 out of 98. In the College Department there were 34 (including one woman) regular students reading for the M.B. and C.M. degree, 44 (including two women) reading for the L.M.S. degree, and 16 casual students, two of whom belonged to the M.B., and 11 to the L.M.S. section. The percentage of passes to the total examined at the University examination was 67·6, against 44·7 in the previous year.

Government having decided to close the Board Medical School at Nellore, no admissions were made into the school during the year, there were, therefore, only five final year's students on the rolls. At the final examination for Hospital Assistant all the 22 candidates passed, with seven in the first-class. At the Prince of Wales' Medical School, Tanjore, there were again 22 pupils on the rolls, eight of whom were native Christians, seven Brahmans, and seven non-Brahman Hindus. Six candidates appeared for the Hospital Assistant examination, and passed.

Bombay. The attendance at the Grant Medical College, Bombay, increased from 250 in 1894 to 305 (including 19 women) in 1895. The results of the examinations were better than in the previous year. For the first University examination in medicine there were 86 candidates, of whom 52 qualified; and for the second examination in medicine 33 passed out of 76 candidates. For the final examination for the degree of L.M.S. there were 41 candidates, and of these only 12 passed, 2 in the first, and 10 in the second class.

The Government Medical School at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The number of students was 191, and of these 68 passed the final examination.

VII.—SANITATION.

In Calcutta further progress was made in the improvement of bustees, or clusters of native huts. The supply of filtered water was increased and the average daily consumption is now equal to 50·09 gallons per head of population for the town proper, and 20·11 gallons for the suburban area. In the course of the year the distribution pipes were extended about 3½ miles, bringing the total length up to 310½ miles, and the total number of premises connected had reached 26,312. The supply of unfiltered water was increased, the daily consumption per head of population being now equal to 13·43 gallons. The length of the unfiltered mains was extended by 1½ miles, bringing the total length of these mains up to a little over 75 miles. At the close of the year (1895–96) the total length of sewers was nearly 209 miles, and the number of premises connected with them was 29,140, of which 528 connexions were made during the year. The new drainage project for the municipality has at last passed out of the stage of preliminary discussion, and the Corporation were considering what course to take on the final conclusions of their professional advisers. Since the close of the year the project has received sanction and its execution commenced. Bengal.

The municipalities of the interior of Bengal spent Rx. 234,483 on sanitary works, an increase of Rx. 73,893 on the sum expended in 1894. The District and Local Boards spent Rx. 111,442 in improving towns and rural areas. No large works were undertaken by the District Boards, but a number of wells were sunk and tanks excavated. A further sum of Rx. 18,887, contributed by private individuals, was expended on sanitary works. The most important sanitary event of the year was the opening of the Howrah water-supply works, on which an additional sum of Rx. 51,343 had been expended. A further sum of Rx. 10,000 was devoted to the Arrah water works; the water is reported to be good, and the quantity consumed each day was 150,000 gallons. The Cossipur-Chitpur water-supply scheme and the drainage schemes for Patna and Muzaffarpur were completed. In many other towns and districts useful sanitary improvements were carried out during the year.

The Sanitary Board held seven meetings in the course of the year, when, among other matters, they discussed the improvement of the water supply of Darjeeling by the construction of settling tanks, the sewerage of the town of Dacca, and the provision of an unfiltered water supply for flushing drains and watering streets; schemes for the supply of drinking water to the towns of Gaya and Berhampore, which last was about to be taken in hand; the drainage and sewerage of Howrah and Krishnagar; and the chemical and bacteriological examination of water supplies. A number of minor sanitary works, including schemes for supplying filtered water to Faridpur and Pabna, and surveys for surface drainage in nine municipalities, were also dealt with by the Board during the year. Among the estimates considered by the Board was that for the extension of the Bhagalpur waterworks at a cost of Rx. 31,400, which received the sanction of Government, and the work was to be commenced as soon as possible.

In the North-Western Provinces and Oudh the municipalities spent over 37 per cent. of their income on water supply, conservancy, and drainage. Progress continued to be made in the sanitation of most of the large towns, and although there was still a lack of skilled local supervisors, expenditure was gradually being directed on more scientific lines. The Cawnpore and the Lucknow waterworks which were opened in the previous year supplied respectively 8·41 and 2·6 gallons per head of population daily, and in each case the quality was reported as satisfactory. The Meerut water supply project, which was sanctioned in the previous year, was completed at a cost of eight lakhs. Water-supply projects for the two large towns of Fyzabad and Bareilly were prepared during the year, but in both cases financial difficulties prevented further progress. At Agra fair progress was made with portions of the drainage and paving schemes, and at Benares 76 per cent. of the work on the main sewer was completed by the end of the year; while at Cawnpore the sewerage and drainage works in the Sadr Bazar were practically finished. A drainage and water-supply project for the town of Farukhabad was also under consideration, a sanitary survey having shown that the existing water supply was bad and the drainage imperfect. North-Western Provinces and Oudh.

The Sanitary Board held four meetings during the year, when attention was given to the question of closing all public and private burial grounds within municipal

limits; the Government order calling for a report on the best method of maintaining village sanitary records; the more pressing drainage works required in the Meerut and Agra divisions; the complete sanitation of places of pilgrimage; and the supply of pure water to pilgrims at the Magh Mela at Allahabad. The Sanitary Board were instructed to prepare a manual relating to the disposal of night-soil at municipal centres, and in consultation with the local authorities to give effect to a series of rules dealing with such measures of rural sanitation as are reasonably within the competence of village communities.

Punjab. In the Punjab the municipal towns spent 22 per cent. of their income on sanitary work. A sum of Rx. 13,943 was realised from the sale of manure and town sweepings in the various municipal towns in the course of the year, as compared with Rx. 12,364 from this source in 1894. During the year the water-supply schemes for Umballa City and Delhi were completed; those for the towns of Pind Dadan Khan and Haripur were in progress; and many others were under consideration. The drainage schemes for Ludhiana, Gujranwala, and Peshawar City were finished; while those for Delhi and Lahore, and the construction of the main outfall sewer at Jhelum, were still in progress. In Gurdaspur district a few drainage works of importance have been made and these, it is reported, will improve the drainage of the country very considerably. A number of works of public utility were also constructed during the year by private individuals at their own expense to serve sanitary purposes.

Four meetings of the Sanitary Board were held during the year, when the following matters were discussed:—Rules to be observed at the more important fairs in the province; causes of the unhealthiness of certain tracts in the Umballa district and Kalsia State; the combined drainage scheme for the city and cantonment of Rawalpindi; the excessive fever death-rate in the province due to water-logging; and the severe outbreak of small-pox in the City of Multan.

Burma. The towns and districts of Burma spent over 36 per cent. of their income on the work of sanitation. No new work of any magnitude was begun; but several large projects were under consideration, the extension of the Rangoon water supply and the establishment of waterworks in the towns of Mandalay and Moulmein being the most important. The population of Rangoon is said to be fast outrunning the present water supply and an elaborate project has been prepared for bringing an adequate supply from Hlawga, 17 miles from the town. The estimated cost of the project is put down at 25 to 30 lakhs, but before burdening the town with such a heavy expenditure the municipal authorities decided to ascertain beyond question whether a sufficiently bountiful supply could not be obtained by sinking tube wells. Experiments were in progress. The Shone and Ault system of conservancy was being gradually extended in Rangoon City, and steady progress was being made with the reclamation of the east of the town. At Prome the filter gallery connected with the pumping station, which had been abandoned for the past nine years, was put into working order, and the majority of the inhabitants of the town are now supplied with water from the hydrants. On several occasions the water was subjected to analysis and pronounced to be good.

The work of the Sanitary Board continued to be restricted to the provision of suitable sanitary maps of the larger towns in Lower Burma. The maps required have now been prepared and steps were being taken to carry out the survey.

Central Provinces. The municipalities of the Central Provinces devoted 16½ per cent. of their income to sanitary purposes. The larger works undertaken or in progress were as usual all in connexion with water supply; drainage works, though urgently needed in some localities, appear to be beyond the means of any municipality. The Jubbulpore waterworks were further extended during the year. A new scheme for supplying Wardha with water at a total cost of Rx. 20,706 was submitted, and the foundation stone of the work was laid by the Chief Commissioner in December 1895. In addition waterworks were in progress at Harda and Khandwa, and a similar scheme for Hoshangabad was about to be commenced. Several minor drainage schemes were carried out during the year. Regarding village sanitation, Dr. Newman says the most rudimentary attempts at sanitation are very rarely found. "As in the towns, so in "the country, the people, with a few extraordinary exceptions, appear not to "understand in the least the danger of neglecting sanitary precautions, and except "where the Sanitation Act is in force, or an official appears to insist on improvement "and supply the necessary funds, nothing whatever is done to prevent filth or remove

" fæcal accumulations from the vicinity of the houses or surface of the streets, to " repair the wells and tanks, or to save them from the foulest pollution."

The Sanitary Board met in each division of the province during the year. At the first annual general meeting held at Nagpur in August statements were presented showing that since the institution of the Board works had been completed at a cost of Rx. 19,264, while those under construction and others to be carried out during the following year would amount to Rx. 5,143.

Excluding the towns of Sunamganj, Karimganj, and Maulvi bazar, in which allowances for sanitary purposes are made by the Local Boards, the municipalities, stations, unions, and towns in Assam spent 44·13 per cent. of their income on sanitary improvements, irrespective of roads and bridges. No sanitary work of special importance was completed, but considerable improvements were effected in the water-works of Gauhati and Shillong, and the first of a series of wells to supply the town of Sylhet with drinking water was completed. A complete drainage scheme for Gauhati was sanctioned and the work was commenced before the close of the year. A similar scheme for Barpeta was under consideration. Steady improvement was made in works for improving the sanitation of villages especially in the way of providing a pure water supply. The question of introducing village sanitary inspection books was under the consideration of the Chief Commissioner, and orders have since been issued bringing these books into use in selected villages from the 1st August 1896. Assam.

The Sanitary Board met twice during the year and were chiefly occupied with the preparation of rules for the sanitation of villages and in drafting a Village Sanitation Regulation.

In improving the sanitation of Madras city several new drains were constructed and old ones repaired during the year. The water supply was extended and increased, but the quality, as in previous years, was pronounced to be bad on chemical examination. " Considering that the supply is unfiltered," the President of the Municipality writes: " This is not much to be wondered at; but, as stated last year, the cost of any " efficient scheme hitherto proposed for filtering the water supply of Madras would " be beyond the means of the municipality." The question of carrying out a comprehensive scheme for the drainage of the whole town was still under the consideration of a committee. Government have granted a sum of $3\frac{1}{2}$ lakhs towards the drainage of the city, and it was expected that the work would shortly be commenced. Madras.

The other municipalities of Madras Presidency allotted 56 per cent. of their income for sanitary purposes, and the District Boards about 9 per cent. Conservancy appears to receive considerably more attention than water supply, judged by the expenditure on each. The Sanitary Commissioner says: " It is far more difficult to get a " municipality to act in the matter of protection of water supply than the disposal " of sewage; sewage is a nuisance that all are glad to get rid of, and so long as the " expenditure contemplated is not very great, petty schemes for its removal are " readily voted for; but to persuade a council that water they have used day by day " for many years on end—albeit that their less lucky contemporaries who also used it " died prematurely—is unfit for use, is not so easy a task." During the year the Sanitary Engineering Department completed surveys for water supply or drainage, or for both, for three municipalities. Two water-supply schemes were submitted to Government, of which one was sanctioned for execution, and four were under the consideration of the Sanitary Board. Six projects were under execution. Of these the Adoni and Tanjore works were completed, and very little remained to be done at Trichinopoly, while fair progress was made with the scheme for the water supply of Dindigul. The improvement of the drainage at Ootacamund received attention and proposals were made as regards an alternative scheme for the water supply of Coonoor. One hundred and fifty-one plans and 120 estimates for sanitary works of the aggregate value of Rx. 26,934 were scrutinised during the year, as compared with 100 plans and 102 estimates of the aggregate value of Rx. 10,470 in 1894.

The Sanitary Board was reconstituted at the beginning of 1895, and amongst the subjects which engaged their attention during the year were the improvement of the water supply of Marlimund at Ootacamund, the drainage of Ootacamund, and filling in the upper portion of the Ootacamund lake, the water supply of Coonoor, sanitary improvements of the town of Cuddapah, schemes for the water supply of Tuticorin, improvement of drainage of Tadpatri, and the improvement of the water supply of Masulipatam.

Bombay. In Bombay city the works in connexion with the sewerage of Colaba on the Shone system were practically completed towards the end of the year at a cost of over 7½ lakhs and in several other divisions of the city drainage and sewerage works were either completed or in progress. The water supply from the Tansa, Vehar, and Tulsi lakes continued to be adequate. During the year 522 new connexions were made and 243 services disconnected on account of buildings demolished and other reasons. The net increase was, therefore, 279, bringing the total up to 19,445.

In Bombay Presidency the municipalities, exclusive of Bombay city, allotted 45·28 per cent. of their income for sanitary purposes. As usual, however, the amount actually expended fell short of the allotment, only Rx. 182,196, or 84·71 per cent., having been spent during the year. Of this sum the outlay on conservancy amounted to Rx. 86,922, on water supplies Rx. 49,654, and on improvement of town sites Rx. 21,598. The District Boards assigned Rx. 78,921 of their income to sanitary works, but only Rx. 51,670, or 65½ per cent., were actually spent, chiefly on improvement of water supply, including cleansing, repairing, and construction of wells and tanks, on which a sum of Rx. 47,620 was expended.

In the course of the year the Sanitary Board gave advice concerning a large number of projects, among which were improvements to the waterworks of Dakor, Alandi, and Kirki, and a water supply scheme for Yeola in Nasik district, the experimental drainage scheme for Ahmedabad, the drainage and sewage of Parel, a draining project for the town of Dhulia, and the question of the house connexions of the Government buildings with the Colaba sewerage system.

Berar. The municipalities of Berar spent 42 per cent. of their income on sanitary improvements. No new works of any magnitude were undertaken during the year, but satisfactory progress was made with the drainage works at Shegaon, and the question of draining Amraoti was under consideration. At Akola steps were being taken for the drainage of the town, and at Akot and Ellichpur considerable proportions of the funds were expended in the same direction.

The District Sanitary Board met once at each of the six head-quarter stations to examine the improvements effected on the recommendations of the provincial Sanitary Commissioner since 1888, the year in which a systematic sanitary survey was started in Berar. In many instances the recommendations were found to have been carried out, but want of funds greatly impeded progress. The question of a sanitary law for the improvement of village sanitation was under consideration.

India Office,
27th October 1897.

W. T. Ronson.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1895.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1895.

(Surgeon-Major General J. Cleghorn, M.D.)

European Troops.

Revision of tables.

In accordance with the instructions and suggestions of the Army Sanitary Commission in their review of the report for 1893, the tables for 1895 appear in a new and simpler form. The recasting has been carried out by re-arrangement and by avoidance of repetition; and the result is that, though the number of tables has been reduced by exactly one-half, yet not only has nothing of importance been omitted, but a considerable amount of fresh information has been furnished. The general plan of the new tables can be easily grasped by looking over the table of contents.

Sickness and mortality in 1895.

Judging from the admission and death-rates, the health of the European army of India was better in 1895 than in the preceding year. The progressive increase in the constantly sick-rate is probably connected with the progressive increase in the number of cases of enteric fever and of venereal diseases, and with the increase since 1890 of influenzal respiratory diseases; that is, with the increase of diseases which keep men long in hospital. The average duration of a case of enteric fever was 52 days and that of a case of venereal disease 31 days.

European Troops in India.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	Total Loss.
1870–79 - - - -	57,742	1,475	60	19·34	43	62
1881–90* - - - -	61,399	1,471	73	14·24	27	42
1894 - - - -	71,082	1,508	92	16·07	25	42
1895 - - - - -	71,031	1,462	94	15·26	23	39

* Including troops in Afghanistan during 1881.

The chief causes of admission were venereal diseases and ague. Among the diseases with increased admission-rates were influenza, enteric fever, remittent fever, and dysentery. On the other hand, the admission-rates from cholera and ague were lessened. Venereal diseases caused 36 per cent. of the total sickness, and ague 23 per cent.

The chief causes of death were enteric fever, hepatic abscess, and dysentery. Among the diseases with increased mortality were dysentery and enteric fever. On the other hand, the mortality from cholera and respiratory diseases was lessened. Enteric fever caused 44 per cent. of the total deaths.

The chief causes of invaliding were, in order, syphilis and gonorrhœa, malarial fevers, debility, tubercle of the lungs, injuries, valvular disease of the heart, rheumatism, mental affections, dysentery, hepatitis, and palpitation.

It has been stated that the mortality per 1,000 of European soldiers in India was for the period 1800–30, 84·60; for the period 1830–56, 56·70; for the period 1869–78,

19·30; for the period 1879–88, 16·02. To this it may be added that the ratio for the period 1889–94 was 15·91.

At page 55 there is a table showing for certain diseases for India the mortality for three periods included in 1870–95, 1870 being the earliest year for which the statistics of India as a whole are available. But, as it is of interest to have also older statistics for comparison, the following table has been prepared for the Bengal Presidency from the earliest available year, 1858, up to 1894, the last year in which the Bengal Presidency existed as a separate command.

The year 1858 being still subject to the disturbing influence of the mutiny, it has been kept separate. The next period was chosen because the late Dr. Bryden stated that from 1858 to 1863 no new regiment was added to the garrison of India. In the year 1870 the short service system was inaugurated in England, and is presumed to have begun to affect India seriously from 1877.

In this office there is no record of enteric fever before 1870, but in the army medical blue book it appears from 1861. The ratios given in the second and third periods in the following table have been derived from the blue books; but no deduction has been made from the other fevers, as it could not be discovered from which the deduction should be made.

The high constantly sick-rate in the fifth period is probably due to the causes mentioned in the first paragraph.

Leaving aside the cases in which increase or decrease has been fluctuating, it may be said that in the fifth period there was increased admission from enteric fever, ague, alcoholism, and venereal diseases; increased death from enteric fever and respiratory diseases; increased invaliding from mental affections, diseases of the organs of the special sense, and injuries; and diminished admission, death, and invaliding ratios under all the remaining and most numerous headings.

The increase of enteric fever and venereal disease is evidently connected with the short service system. The increase in ague may be due to exposure on active service, and to the addition to the empire of large malarious regions on the north-western and eastern frontiers. The increase in mortality from respiratory diseases is pretty certainly due to the epidemic influenza, which has not left the country since it first appeared in 1890. The decrease in cholera, scurvy, and some other diseases may be put down to improved hygiene. The decrease in remittent and in simple continued fever is probably mostly due to change in diagnosis, and transfer to the head of enteric fever. Hepatitis was shown by Dr. Bryden to be a disease of degeneration, a disease of the old soldier. Its diminution appears, therefore, to be a good result of the short service system.

Bengal Presidency.

Period.	1858.	1859–63.	1864–69.	1870–76.	1877–94.
Constantly Sick Rate per 1,000.	112·6	81·2	57·9	58·4	76·4
Diseases.	Admission-Rate per 1,000.				
Cholera	16·9	19·7	9·8	4·3	3·8
Small-pox	7·2	2·5	1·9	·7	·8
Enteric fever	—	·2	·9	3·7	16·4
Intermittent fever	605·2	455·6	393·3	397·3	468·1
Remittent fever	167·6	85·4	39·5	29·1	13·8
Simple continued fever	605·3	215·0	106·5	147·7	77·0
Apolexy and heatstroke	43·0	4·5	5·3	3·4	4·0
Alcoholism	6·1	6·0	4·4	3·3	7·5
Respiratory diseases	100·5	76·7	59·0	60·5	47·7
Phthisis pulmonalis	8·2	6·8	8·3	8·9	4·7
Dysentery	202·7	74·0	39·5	30·8	29·1
Diarrhœa	279·0	135·4	93·7	59·8	48·2
Hepatitis	67·1	63·6	56·3	50·6	25·2
Spleen diseaases	—	—	6·6	7·4	4·5
Scurvy	—	—	1·1	·5	1·0
Venereal diseases	261·5	335·1	213·3	196·5	357·1
All Causes	3,111·3	2,039·6	1,565·5	1,478·9	1,562·7

Diseases.	Death-Rate per 1,000.				
	1858.	1859–63.	1864–69.	1870–76.	1877–94.
Cholera	9·16	11·64	6·46	2·88	2·69
Small-pox	1·71	·42	·25	·13	·08
Enteric fever	—	·12	·45	1·69	4·72
Intermittent fever	1·85	·72	·66	·09	·17
Remittent fever	5·09	1·64	1·31	1·03	·84
Simple continued fever	11·63	2·09	1·43	·47	·07
Apoplexy and heatstroke	17·77	2·17	2·48	1·43	1·24
Alcoholism	·64	·58	·42	·15	·17
Respiratory diseases	2·42	1·02	·94	1·10	1·19
Phthisis pulmonalis	2.19	1·86	1·57	1·26	·82
Dysentery	27·14	5·11	2·05	1·25	·91
Diarrhœa	6·53	1·40	·47	·11	·15
Hepatitis	5·85	3·64	3·35	2·20	1·30
Spleen diseases	—	—	·03	·05	·02
Scurvy	—	—	·04	·02	·01
All Causes	111·10	36·90	26·57	18·70	18·06

Diseases.	Invaliding-Rate per 1,000.				
	1858.	1859–63.	1864–69.	1870–76.	1877–94.
Dysentery	5·67*	1·92	1·77	1·43	1·01
Fevers	3·22	1·90	2·54	1·94	1·71
Venereal diseases	1·01	1·48	3·04	1·94	1·72
Debility	2·01	3·13	7·65	7·22	5·41
Rheumatism	4·36	5·33	3·94	2·46	1·19
Phthisis pulmonalis	1·33	1·52	3·45	3·68	2·00
Mental diseases	·55	·71	·83	1·15	1·21
Epilepsy	·34	·56	·79	·58	·51
Other nervous diseases	·82	·90	1·87	·82	·62
Eye, ear, and nose diseases	1·51	2·18	1·08	·97	1·34
Palpitation	·55	·41	·25	2·25	1·43
Other circulatory diseases	1·42	1·54	3·79	3·30	1·97
Respiratory diseases	1·60	1·29	1·57	1·51	·67
Hepatitis and hepatic abscess	4·66	4·70	6·38	6·39	2·28
Locomotive diseases	·34	·38	·67	·62	·67
Injuries†	5·96	·96	·87	·90	1·20
All Causes	43·59	32·52	46·04	41·31	27·85

* Including diarrhœa.

† Including apoplexy up to 1870.

The total fever mortalities of the four forms of fever given in the table are, for the periods given, respectively 18·57, 4·57, 3·85, 3·28, and 5·80. The total fever mortality has therefore risen since the Indian army came under the short service system. But, nevertheless, the total mortality from all causes has been reduced.

In the period 1859–63 the maximum death-rate was 44·77, the minimum 22·49, and the ratios of two of the years were above the period ratio; in 1864–69 the maximum death-rate was 42·89, the minimum 20·11, and two of the years had ratios above the period ratio; in 1870–76 the maximum death-rate was 27·45, the minimum 14·62, and two of the years had ratios above the period ratio; in 1877–94 the maximum death-rate was 44·15, the minimum 11·21, and five of the years had ratios above the period ratio. Very high ratios were therefore exceptional in all the periods. The two highest ratios in the last period were those of 1879 and 1880, the years of the Afghan war. The death-rate was at its lowest from 1882 to 1885; cholera, fevers, respiratory diseases, and bowel complaints all giving low mortalities. Since 1885 the death-rates have been higher, the maximum 19·81 and the minimum 14·35. The increase is probably connected with the conquest and occupation of fresh territories on the eastern and north-western frontiers. Some of the years with high ratios, such as 1891, 1892, and 1894, were also distinguished by prevalence of cholera. It is usual for the Bengal-Punjab death-rate to be higher than that of Madras or Bombay.

The ratios of the four commands are shown in the following table. Bengal had the highest mortality from cholera, dysentery, and hepatic abscess; the Punjab the

highest from enteric fever, malarial fevers, heatstroke, and pneumonia; Madras the lowest from enteric fever and pneumonia; Bombay the lowest from dysentry. The percentage of enteric fever in total deaths was greatest in the Punjab, and the percentage of hepatic abscess in Madras. The total death-rate of the Punjab, which was the highest, was more than double that of Madras, which was the lowest.

Ratios of Commands.

	Ratio per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.*
I.—Strength	22,259	19,733	13,417	15,622	71,031
II.—Constantly Sick Rate	97·8	92·0	91·4	91·9	93·7
III.—Admission Rate of the Year:—					
Influenza	3·1	9·0	21·0	1·5	7·8
Cholera	1·2	·1	·8	·3	·6
Small-pox	·3	·2	·4	·2	·3
Enteric fever	30·3	39·0	12·7	16·3	26·3
Intermittent fever	249·9	452·5	118·3	498·3	336·0
Remittent fever	17·1	14·8	9·0	9·0	13·1
Simple continued fever	26·2	13·8	24·0	22·6	21·6
Tubercle of the lungs	4·4	1·1	9·8	4·7	4·8
Pneumonia	1·8	9·4	1·7	3·9	4·4
Other respiratory diseases	20·9	41·0	21·8	28·7	28·4
Dysentery	36·2	45·6	39·9	17·9	35·5
Diarrhœa	21·3	35·0	11·3	24·9	24·0
Hepatic abscess	2·5	1·5	2·1	2·6	2·2
„ congestion and inflammation	17·2	11·8	26·8	15·9	17·2
Venereal diseases	605·2	419·3	530·7	526·8	522·3
All Causes	1,436·3	1,519·4	1,226·9	1,627·3	1,461·8
IV.—Death-rate of the Year:—					
Cholera	·85	—	·60	·32	·45
Small-pox	·04	—	·07	—	·03
Enteric fever	7·59	10·29	2·61	4·48	6·72
Intermittent fever	·18	·41	·07	·32	·25
Remittent fever	·09	·66	·22	·19	·30
Simple continued fever	—	—	—	·19	·04
Heat-stroke	·76	1·42	·22	·77	·84
Circulatory diseases	·27	·30	·45	·45	·35
Tubercle of the lungs	·81	·71	·15	·19	·52
Pneumonia	·18	1·11	·15	·51	·51
Other respiratory diseases	·09	—	·07	·06	·06
Dysentry	1·48	1·37	·52	·45	1·04
Diarrhœa	—	·20	—	·06	·07
Hepatic abscess	1·66	1·01	1·34	1·60	1·41
All Causes	16·98	20·02	8·79	12·35	15·26

* For complete detail of diseases *see* Table LIII.

The following table gives vital statistics of the European troops in Burma as a whole:—

Period.	Strength.	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths from		
				Cholera.	Other Causes.	Total.
1890	4,712	1,743	102	—	20·80	20·80
1891	4,623	1,589	92	2·38	17·74	20·12
1892	4,316	1,491	91	—	14·83	14·83
1893	3,928	1,461	96	·25	12·73	12·98
1894	3,940	1,465	93	·25	9·39	9·64
1895	4,045	1,410	96	·99	8·41	9·39

Burma in 1895 was distinguished by the prevalence of influenza and hepatitis,

The following table shows that, judging by the constantly sick rate, Groups II., XII*b*., and V. were the most unhealthy for the decennium, and XII*a*. the most healthy. It also shows that the 1895 constantly sick rate of every group except XI. was higher than its corresponding decennial ratio, and that the rise was greatest in the case of IX., VIII., and XII*a*. But the constantly sick ratios of six groups were better than in the previous year:— Geographical groups.

		Ratio per 1,000 of Strength.												
		I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
		Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	Indus Valley and North Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Depôts.	India.
1882–91	Constantly sick	74·6	91·4	82·8	83·0	81·6	79·4	78·8	69·8	72·0	75·7	65·1	90·6	74·0
	Death—Cholera	·35	2·24	1·10	3·45	1·04	·85	2·19	·85	—	·38	1·51	·94	1·49
	Death—Enteric fever	2·37	2·31	2·09	5·87	5·33	3·69	5·66	3·71	1·71	2·66	4·44	3·67	4·13
1894	Constantly sick	97·5	94·8	89·9	105·7	99·3	96·2	113·2	86·4	75·2	80·5	84·3	90·5	91·6
	Death—Cholera	—	·38	·45	18·22	·14	—	—	·20	—	—	—	—	2·10
	Death—Enteric fever	·88	1·89	3·57	6·38	7·63	7·33	7·39	5·53	1·17	3·55	6·28	8·22	5·75
1895	Constantly sick	86·4	102·4	96·9	105·4	94·1	87·6	104·8	97·2	83·3	71·5	90·6	105·0	93·7
	Death—Cholera	—	1·51	·88	2·12	·14	—	·63	·52	—	—	—	—	·45
	Death—Enteric fever	4·04	1·51	6·16	7·36	6·61	8·18	7·40	5·16	2·56	1·32	5·36	3·90	6·72

Gangetic Plain had the highest constantly sick rate; Indus Valley the highest admission and death rates; and Southern India the lowest constantly sick, admission, and death rates; Burma Coast had the highest admission rates from influenza, and the lowest from remittent fever, simple continued fever, tubercle of the lungs, respiratory diseases other than pneumonia, and diarrhœa; Burma Inland the highest from hepatitis, and the lowest from pneumonia and abscess of the liver; Gangetic Plain the highest from cholera, enteric fever, and venereal diseases; Upper Sub-Himalayan the lowest from hepatitis; Indus Valley the highest from ague, pneumonia, other respiratory diseases, and diarrhœa; Western Coast the highest from simple continued fever, and the lowest from ague and dysentery.

In the decennium also the Gangetic Plain had the highest admission ratios from cholera and enteric fever.

The percentage of enteric fever to total admissions in 1895 was greatest in the Gangetic Plain; of hepatic abscess and venereal diseases in Burma Coast; of remittent fever and dysentery in Bengal-Orissa; of ague, pneumonia, and other respiratory diseases in the Indus Valley; of simple continued fever in Western Coast.

The highest ratios among the large garrisons with a strength of over 1,000 were those of Lucknow, Peshawar, Chakrata, and Aden, and, except in the case of Lucknow, these ratios were higher than those of the preceding year. Stations.

Sickness and mortality having been studied in their relation to India, to commands, to geographical groups, to stations, and to regiments, it will be convenient here to discuss the statistics of some of the chief diseases. After a pause of two months influenza began again in January 1895, reached its maximum in April, sank gradually till August, and rose again gradually till December. The following table shows the increase in 1895 over 1894. It also shows the fluctuations of the disease since 1890, the first epidemic year:— Principal diseases: Influenza.

Admissions from Influenza.

Period.	India.													
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Per 1,000 of strength.
1890	—	3	473	1,451	248	69	13	2	3	—	—	1	2,263	33·4
1891	1	—	1	16	77	91	112	29	20	2	2	21	372	5·5
1892	113	53	354	241	57	4	32	8	—	—	—	—	862	12·7
1893	1	—	—	15	4	—	—	—	—	—	—	1	21	·3
1894	7	9	12	70	101	30	7	7	—	2	—	—	245	3·4
1895	14	7	52	156	66	35	17	1	5	13	23	165	554	7·8
Total	136	72	892	1,949	553	229	181	47	28	17	25	188	4,317	—

The actual maximum of the individual years of the six occurred in various different months, but over the six year period as a whole the greatest number of cases occurred in March, April, and May, the hot dry months before the rains, and the smallest number in the four months August to November. Geographical Groups I., V., VI., VIII., XI., and XII*a*. were attacked both in 1895 and in 1894; Groups II., VII., IX., and XII*b*. in 1895 only, while Groups IV. and X. were spared in both years. 23 stations were attacked in 1895 against 20, nine of them suffering in both years. Among stations Rangoon and Sialkot had the greatest number of cases. The outbreak at Sialkot was a very compact one, confined to one month, while at Rangoon cases occurred in eight months of the year. The average number of men constantly sick with influenza was 16 and the average duration of a case 10 days. The returns deal, of course, only with those cases which were admitted into hospital, but there were mild cases not admitted.

Cholera.

The amount of cholera was much less than in the previous year, and very low, as may be seen from the following table:—

Cholera.

Period.	India.			
	Admissions.		Deaths.	
	Number.	Per 1,000 of Strength.	Number.	Per 1,000 of Strength.
1870–79	2,697	4·7	1,864	3·22
1881–90	1,320	2·1	899	1·46
1894	209	2·9	149	2·10
1895	44	·6	32	·45

The disease was at its maximum in May, and was epidemic only at Fyzabad and Secunderabad.

Small-pox.

The admission rate rose slightly, the death-rate fell slightly. The death-rate was only one-third of the decennial death-rate. The greatest number of cases at any one station was four at Bangalore, and three each at Saugor and Rawalpindi.

Fevers.

Ague gave rise to about 23 per cent. of the admissions from all causes. The most noteworthy feature of the monsoon rains of 1895 was their general deficiency over the whole of India to the north of latitude 18°. With this may be connected the fact that the year was decidedly less malarious than its predecessor:—

Period.	Intermittent Fever.		Remittent Fever.		Simple continued Fever.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–91	330	·15	8	·53	73	·05
1894	412	·18	9	·37	20	·01
1895	336	·25	13	·30	22	·04

As shown above, there was a considerable rise in the admission rate from remittent fever. This was partly due to the occurrence of a large number of cases in the Chitral Field Force; but there was also an enormous increase in the Bengal-Orissa group, the admission ratio having risen from 15·2 to 65·5. The increase occurred at Calcutta and Dum-Dum. The medical officer of the former station says:—"The "increase is partly to be accounted for as occurring in a regiment, the 1st Shropshire "Light Infanty, which had suffered a good deal from malaria in Hong-Kong previous "to coming here, and partly to a general increase of these fevers in this town from "some cause which could not be accounted for."

Enteric fever.

It must be confessed that increased experience has not on the whole made the bacteriological investigation of disease easier. The progress of knowledge has revealed how little is known; the characters of many bacteria do not appear so sharply defined as at first, and identification has become a complicated and laborious process. This is specially true as regards the examination of water for specific microbes, and not least so in the case of the enteric bacillus. The difficulty is so great that men like Duclaux, Kruse, Buchanan, Gaertner, Löffler, and others have said that whether a water is safe or not cannot be found out by chemical or bacteriological analysis in a laboratory, without also going to the spot and examining into the local possibilities of contamination. If the bacteriologist has to do, on the one hand, with a cultivation of the enteric bacillus made from the spleen of a patient dead of enteric fever, and, on the other, with a cultivation of *bacillus coli* derived from healthy fæces, he finds, on employing a complete series of the accepted tests, that the two are distinguished from each other by certain well-defined characters. But when the material to be analysed is a sample of suspected water, great difficulties have to be overcome. The first difficulty is that the analyst can never be sure that his negative results are correct, even if he deals with litres instead of with drops, because of the probably sparse diffusion of the bacilli in a relatively vast bulk of water. The necessity of using large quantities of the water, and of caution in proclaiming negative results, has lately been specially emphasized by Klein, who has also remarked that the search is like looking for a needle in a rick of hay. The second difficulty is the presence in the water, often in enormous numbers, of the ordinary water-bacteria, especially of those which liquefy gelatine. No primary process has yet been discovered which will separate the enteric bacillus *alone* from these. The most frequently employed processes, such as that of Parietti, can only separate the enteric bacillus, the *bacillus coli*, and certain intermediate forms from the more ordinary microbial inhabitants, leaving to another stage the separation of the enteric bacillus from those resembling it. The third difficulty is the extremely frequent occurrence of the *bacillus coli*, in water, the family likeness between the *bacillus coli* and the enteric bacillus, and the existence of forms intermediate between the two. As an example of the kind of difficulty caused by these intermediate forms the following may be adduced:—Wernicke and Bussenius examined the typhoid like bacilli from the wells of a farm, where cases of enteric fever had occurred. Only after careful testing they got a microbe with the greatest likeness to the enteric bacillus, except in its behaviour to sugar and to milk. But, as they considered that they had sometimes observed slight gas-production in cultures of the enteric bacillus in saccharine media, they were inclined to regard this bacillus found in the water as an enteric bacillus rendered abnormal by continued saprophytic existence in water. This conclusion comes near certain views of Hankin regarding the degeneration of specific microbes in water. Hankin is supported by McWeeney in the opinion that these abnormal forms are at least companions of the enteric bacillus in water.

"*Hankin.*—Like other authors, I have found that there exists a whole series of intermediate gradations between what I believe to be the typical enteric microbe and the bacillus coli communis. Practically this fact does not present such difficulties in diagnosis as might be expected, as very generally when these are detected the enteric microbe can also be found if sufficient care be exercised. It is clear that microbes allied in their cultural characters to that of enteric fever are found so rarely in the absence of the typical enteric microbe, as not greatly to detract from the value of the test.

"*McWeeney.*—To these conclusions I wish to add one other, which is founded upon a large number of biological investigations made by me during the last few years upon water suspected of being the vehicle of typhoid germs, namely, that these pseudo typhoid or coliform organisms occur regularly and abundantly in water to which attaches the suspicion of causing typhoid fever, very seldom and in small numbers in water which is beyond the possibility of sewage contamination."

Possibly a more extended application of the serum test of Pfeiffer may clear up some of the difficulties caused by the presence of these intermediate forms.

"*Pfeiffer.*—In the serum of enteric convalescents there are present substances which in small quantities kill and dissolve living enteric bacilli in the bodies of guinea-pigs. The action of the bactericidal substances of the serum is specific; it affects only enteric bacilli, not enteric-like bacilli. It can therefore be used for distinguishing the true enteric bacillus from those related to it or like it. The demonstration of the specific bactericidal substances of the serum of enteric convalescents is a new proof that the typhoid bacillus alone plays the etiological rôle in enteric fever and is specific."

Pfeiffer's statements have been confirmed by other competent observers. This serum test of Pfeiffer's seems, then, to be at present the only known certain test for the enteric bacillus; but its application requires judgment as well as skill. The method is not only used for the differentiation of the enteric bacillus in the laboratory, but has been employed with success in Paris and elsewhere for the diagnosis of enteric fever, bacilli from an authentic culture being treated with a few drops of the patient's serum. Klein has lately stated that the method is more certain in the test-tube than in the body. Elsner's new culture medium (acid potato-juice gelatine with potassium iodide) has rendered the detection of the enteric bacillus much easier than before. This medium eliminates the ordinary water saprophytes, and at the same time differentiates the enteric bacillus from the *bacillus coli* by the much slower rate of growth in it of the former. It has been applied with great success to the detection of the bacillus in the stools, and Elsner hopes by its aid to be able to study the occurrence of the enteric bacillus in nature apart from cases of enteric fever. Separation by Elsner's medium and confirmation by Pfeiffer's serum constitute the most perfect process yet discovered for the purpose. Petruschky's litmus whey process confirmed by Pfeiffer's serum seems to be also a very satisfactory method. For water the best procedure seems to be:—(1.) Passing a considerable quantity of the water through a Pasteur filter, and using the deposit on the cylinders for the analysis; (2.) Elimination of ordinary saprophytes by Parietti's method, or, better still,* the omission of this second stage, and, with the use of Elsner's medium, passing direct to (3.) The making and examination of plate and streak cultivations; (4.) The differentiation of the enteric bacillus from enteric-like forms by the acid-production test (Petruschky's litmus whey, litmus agar), by the milk-coagulation test, by the gas-production test, by the indol-production test, by the classical potato test, by Pfeiffer's serum test, and by other tests the constant addition to the number of which of itself sufficiently indicates how little satisfied observers are with those they already possess. The microscopical characters are not much trusted to now-a-days, though they should be used as contributary confirmations. In all European laboratories also standard cultivations of the enteric bacillus from the spleen and of the *bacillus coli* from fæces are kept up for purposes of comparison. When a doubtful microbe is found in the course of a research, its behaviour to the usual tests is compared with that of the standard to the same. Mr. Hankin in India has not often been able to use the filter method in the first stage, as the samples sent to him have been too small. For the second stage he uses a modification of Parietti's process; for the third, zig-zag cultures on agar in tubes; for the fourth, litmus agar, potato, milk, and the microscope. It will be noticed that some of the tests given above are not used by Mr. Hankin; but his method as it stands is already so complicated and laborious that it is a matter for astonishment that he should be able to carry out the process thoroughly in so many cases, considering the amount of other work, bacteriological and chemical, that has to be got through at Agra. There ought to be half-a-dozen expert bacteriologists instead of one for the work as it is at present, and the work will increase. An augmentation of the number of bacteriologists would also be advantageous in the way of check; it is not good for a bacteriologist to be alone, with no one to contradict him. Bacteriologists in Europe appear to distrust each other in the matter of the detection of the enteric bacillus in water, unless the most rigorous proof be forthcoming; and in their own work they do not always arrive at more than a probability. Mr. Hankin says himself that his method was more or less tentative, but appeals to results in the improvement of health of stations, as shown by answers of medical officers to a circular of his, as justifying his diagnoses. But, unfortunately, a scrutiny of these "results" showed that their accuracy left a great deal to be desired; and judgment must remain suspended.

It is in view of the great and increasing importance of enteric fever as a disease of the British troops in India, and of the prominence which has been given to the alleged detection of the specific bacillus in the food and water supplies of the soldier,

* Lösener and others altogether distrust Parietti's method, and those like it, preferring to add the phenol directly to the gelatine or agar from which the plate cultivations are to be made.

that it has seemed necessary to give the above brief account of the latest views of experts concerning this bacillus and its relation to enteric fever. Medical officers in India have not always the opportunity of consulting the works of bacteriological specialists; and a *résumé* of what is at present known and believed about the subject will be, no doubt, of interest and of practical benefit to them.

It is too generally assumed that the detection of the bacillus is a very simple matter, and that the connexion between the presence of the bacillus and the occurrence of enteric fever is unquestioned and unquestionable. These beliefs are, however, not in accordance with the opinions expressed in some of the latest English and German writings on the subject, published in 1896 :—

"*Kruse.*—The differential diagnosis of the typhoid bacilli, which was formerly quite simple, has now become very complicated, since the knowledge of the related bacteria of the colon-group has been attained. No single character is peculiar to the typhoid bacillus: only by the presence of all its characters in their totality can it be differentiated. . . . . A certain variability, however, attaches to some of these characters.

"*Pfeiffer.*—Notwithstanding these really great difficulties, cholera bacilli have already been demonstrated with certainty in a whole series of cases in well, river, and pipe water. On the other hand, the statements hitherto made regarding the finding of enteric bacilli in water are to be criticised very sceptically.

"*Dreschfeld.*—In conducting bacteriological examination of water, it must be borne in mind that a number of bacilli may occur in water which closely resemble the typhoid bacillus both in appearance, in the character of the colonies, and even in some of the re-actions; so that it becomes necessary to use every one of the differential tests given above; indeed, in the present state of our knowledge, even if the organism do present the various test re-actions, we can then only say that it is like the typhoid bacillus.

"*Crookshank.*—Whether this bacillus is really peculiar to typhoid is much disputed. Bacilli very closely resembling it, if not actually identical, have been found under other conditions. These pseudo-typhoid bacilli are regarded by some bacteriologists as varieties resulting from the different environment afforded by a saprophytic existence. . . . . Sufficient has been said to show that bacteriological reports in which it is stated that the typhoid fever bacillus has been found in water causing typhoid epidemics must be accepted with great reserve; and, further, no one is justified in stating that the typhoid fever bacillus is undoubtedly the cause of typhoid fever."

Readers of the above quotations who wish to realise how widely felt is the difficulty of detecting the enteric bacillus in water, and how common the *bacillus coli* is in water and elsewhere, may do so by a perusal of the papers to which references (not reprinted) are given at the end of this section.

Klein has lately shown that the enteric bacillus can live longer in water and in sewage than had, from various experiments, been supposed. Like others he found that waters of different sources or of different treatment (sterilised, boiled, filtered, &c.) are apt to have different effects upon the bacillus. If the enteric bacillus gains access to a pure water, the length of its life therein appears to be determined by the amount of organic matter present in the water or carried into it along with the bacilli. Hankin also records the following :—

"My assistant, Dr. Gadially, has recently noticed that when a particular microbe is present in specimens of water or milk sent to my laboratory, the enteric microbe is never met with. I propose to call this microbe the 'micrococcus Gadiallii.' We have isolated it, and found that it has the power of destroying the enteric microbe in water, bouillon and milk. Possibly the presence of this or similar microbes in bazar wells is one reason why they are so rarely infected with enteric. Drinking their water may produce dysentery, malaria, cholera, or liver abscess, but it would appear to be the way to avoid enteric."

Other experimenters have also occupied themselves with the behaviour of the enteric bacillus in different waters.

Mr. Hankin has brought to the notice of regimental authorities and others the desirability of keeping aërated waters for some time before use. The following are very interesting and important remarks by G. C. Frankland on the same subject :—

"As regards typhoid infected water we cannot resort with any degree of security to carbonated waters, unless we have proof that the manufactured article has been stored for at least a fortnight before use. Slater observed typhoid bacilli alive in ordinary aerated water as long as 11 days; and both Abba and Hochstetter record a vitality of five days. In some cases, however, they seem to disappear much more rapidly, and doubtless a great deal depends upon the initial vital condition of the particular cultivation of typhoid bacilli employed. Here again Dr. Abba finds in *sterilised* alkalised aërated water that the persistence of the typhoid bacillus is superior to that observed in similar waters not deprived of their bacterial life. (The coli behaves in the same way, but is more hardy.) It would appear reasonable, therefore, to make a practice of storing such waters before distribution, a measure recommended many years ago by Duclaux, and which, in the absence of

preliminary precautions, such as the removal of all bacteria present by boiling, distillation, or efficient filtration, would appear to be a measure of great hygienic importance."

Dempster, in the course of an inquiry into the influence of different soils, found that in dry earth the enteric bacillus soon perished, but that the presence of moisture enabled it to live long.

Diffuse daylight appears to have little influence on the bacillus, and the effect of direct sunlight is dependent on the simultaneous presence or absence of air; in the former case the bacillus quickly perishes.

Lösener found that in unburied bodies the enteric bacillus lived three or four days, but in buried bodies they could be found up to 96 days.

In a fœtus aborted in the course of its mother's fever, Freund and Levy found the enteric bacillus in the spleen of the fœtus and in the placental blood; while the intestinal mucous membrane, "as usual in intrauterine typhoid," was normal.

Thiemich and Teissier found the bacillus in the blood of the rose spots and of veins; and in four of the cases the diagnosis was confirmed by *post-mortem* examination.

As to the enteric bacillus and the coli in the urine there are some new observations. Judalewitch says that the enteric bacillus can pass in the urine, and this is not dependent on parenchymatous nephritis, in the third week, and some time after convalescence; and that the disinfection of the urine may in some cases restrain the spread of the disease. Baart de la Faille says that the presence of the enteric bacillus in the urine is almost invariably associated with albuminuria, and frequently with acute nephritis. In 27 cases he found the enteric bacillus four times, the *bacillus coli* four times, and other bacteria in the other cases. He thinks the specimens of the enteric bacillus he found were real; but acknowledges that the methods employed may possibly have brought forward a variety of the bacillus closely resembling the enteric bacillus. Kruse states that the analyst has the prospect of finding the enteric bacillus in the urine in about half the cases examined.

Pfuhl in the course of a certain investigation found reason to believe that the disease may have been spread in barracks by the use of old clothes and other articles that had belonged to men dead of enteric fever.

The experiments of Alessi, referred to in the report for 1894, page 26, have been repeated by Abbott, who found, in contradiction to Alessi, that the gases of putrefaction do not predispose to enteric fever. But, nevertheless, it must be believed that the inhalation of the gases of putrefaction by men accustomed to fresh air, cannot but have a depressing effect, and render the men an easier prey to the microbe of any infectious disease. Hueppe, page 239.

Piorkowski found that the enteric bacillus, like some others, can penetrate into the interior of unbroken eggs.

The possibility of enteric fever being an auto-infection has several times been raised by medical officers in India, and it is a favourite view with the Lyons school of bacteriologists. Thus Rodet asserts:—

"The coli and the enteric are varieties of the same, and there are other varieties within and beyond. The coli is the cause of typhoid, because the enteric bacillus is extremely seldom found in water, but almost always the coli; and in the dejections the colon bacilli are numerous, while the enteric bacilli are rare. As the bacillus coli is present in every body, the change to the enteric bacillus must be rare, and the new characters are acquired within the body."

McWeeney also says:—

"I do not believe that there is a radical division between the typhoid bacillus and the bacillus coli. The characters which distinguish them are all mutable. There are clinical facts which show that auto-intoxication from one's own bowels may take place, and the bacillus coli may set up inflammation in the Peyer's patches and toxic substances may be absorbed, giving rise to symptoms the same as in typhoid fever."

Again, Hueppe remarks:—

"There are two views at present. The one which up to now seems to me to have the best foundation is that the enteric bacillus and the bacillus coli are two different species. The other is that an ordinary intestinal saprophyte, the bacillus coli, is a resident parasite, which under special influences becomes invasive, and appears as the enteric bacillus."

Other observers have drawn attention to the extended pathogenic activity of the *bacillus coli*.

The researches of Lösener, referred to on page 26 of the report for 1894, in the course of which he found bacilli indistinguishable from that of enteric fever in the intestinal contents of a buried pig, in specimens of earth, in the fæces of a healthy

man, and in the waste water of his laboratory, have been extended by Remlinger and Schneider of the Val de Grace hospital laboratory, who at the meeting of the Paris Society of Biology of 18th July 1896 reported that with the help of Elsner's medium they had isolated micro-organisms from water, earth, and the stools of men not sick of enteric fever, which were not to be distinguished from the enteric bacillus, gave the specific reaction with Pfeiffer's serum, and stood the potato, gelatine, indol, and lactose tests. They found this bacillus in eight out of 36 specimens of water, in six out of 10 specimens of earth, and in the stools of three men suffering respectively from leucocythæmia, malaria, and nephritis. Two of the specimens of water came from a town in which enteric fever was prevailing, five from places in which typhoid fever had been present months before, though during the epidemic the same methods had not demonstrated the presence of the bacilli. The specimens of earth were obtained partly from the surface of the ground and partly from a depth of 50 centimetres. Twelve out of 18 specimens of these bacilli killed guinea-pigs, when injected into the peritoneum, but it was found that a previous inoculation of Pfeiffer's serum prevented a fatal result. Other organisms were found in water, earth, and fæces, which had the morphological and biological characters of the enteric bacillus, but did not react to the serum. If these results be confirmed, they seem likely to necessitate some change in present views as to the causation and mode of origination of enteric fever.

It has been well said that not only does India now receive, under the short service system, a large and constant supply of susceptible material, but that each case may contribute a large number of bacilli to aid in the spread of the disease. The aims of the sanitary officer must therefore be to destroy as many bacilli as possible, to prevent the survivors obtaining entrance to the bodies of the soldiers, and to maintain the bodily resisting power of the latter, not only for the sake of the individual, but because it has been suggested that pathogenic microbes passing through a body whose resistance they have been unable to overcome, may be rendered weaker. Hueppe, page 239. As to the first point, the recommendation made in the report for 1894, that the stools and urine* of enteric fever patients should be totally destroyed by fire, may be here repeated, with the addition that this process should be continued for at least 10 days or a fortnight after convalescence has been established. All water and milk should be boiled before use, and should not be liable to contamination between boiling and use. Water should also be treated with permanganate of potassium according to the directions issued by Mr. Hankin. The next desideratum should be striven after by the exercise of cleanliness in all things. Constant attention should be devoted to the water supply from its source to the mouths of men. It should run from the source in closed pipes, and there should be no possibility of contamination between the standpipe and the consumer. The milk supply requires equally great care, including the establishment of proper dairies under efficient supervision; and both these points are receiving much attention. The manufacture of aërated drinks should everywhere be put under strict regulation and supervision; and, where it is possible, such drinks should be stored after manufacture for 14 days before being used. The men should be fully warned as to the danger of partaking of food and drink from unknown, or from obviously unclean sources. For so long as the bazars and the habits of the people who live in them remain as dirty as at present, and so long as the soldier goes thither to eat and drink all sorts of filth, so long will this second desideratum be imperfectly attained. The third object would no doubt to some extent be gained by the substitution in the garrison of India of older and more seasoned men; but this may perhaps be regarded as beyond the range of practical proposals. The next best thing is greater attention to the personal hygiene of the men.

Finally, it must be borne in mind that, though now-a-days more is known about enteric fever than in former times, still much remains involved in mystery; and that, as all the avenues of approach of the disease may not have been discovered, no single point of hygiene should be neglected. In the barracks the men are cleanly and enjoy, or ought to enjoy, pure air, earth, water, and food; but in the bazars close by is filth abounding, always at hand to poison the men, when they make their too frequent visits, and ever ready for the numerous accidents which mysteriously introduce its sullying and fatal presence into these laboriously and gradually attained cantonment purities.

Most medical officers lay stress on the influence of climate acting on young and unseasoned soldiers; but the medical officers at Fatehgarh, Pachmarhi, Benares, and

* The bacillus is said to have been found in the sputum and also in the sweat.

Bangalore, give instances where men of greater age or longer service did not enjoy any comparative exemption. Three men are said to have disembarked in India with the disease on them; and some new arrivals were supposed to have contracted the disease *en route* from Bombay to Agra, to Sialkot, and to Bangalore. Again, medical officers frequently noted, especially in the case of hill stations, that the disease must have been contracted before arrival, either from impurities encountered on the march, or from a cause existing in the previous station; so that the station where the disease was treated was not always the station in which it was contracted. In a number of the cases admitted at Kuldunnah, Gharial, and Peshawar, the disease had been contracted on service with the Chitral Field Force. It was supposed that the Field Force took enteric fever with it from India, and that local circumstances, such as deficient conservancy establishment, fouling of the ground, and the presence of large numbers of flies, favoured the increase and spread of the disease. Some patients acknowledged having used foul water in the jungle, on the rifle range, or when marching from the plains to the hills. The water supply was considered to be liable to contamination at Chakrata, Nowshera, Mhow, and Bangalore. The combined result of 10 stations was that 72 cases occurred in total abstainers, and 129 in non-abstainers, or 36 and 64 per cent. respectively. But, as their average annual strengths cannot be obtained, no conclusion can be drawn as to the relative liability of these two classes. The medical officer at Lucknow bewails the fact that though the new water supply by pipes was in use throughout the year there was more enteric fever than in any of the preceding three years, and believes that the men frequently contract enteric fever, as they do venereal disease, in the native bazars. Like many other medical officers, he looks with the greatest suspicion on the liquid refreshments of which the men partake in those places. The danger of a double water supply, one for drinking and one for washing purposes, is noted in the reports from Chaubattia, Satara, Nasirabad, and Taragarh. Other dangerous practices mentioned are washing dishes in dirty water, and bathing in foul ponds. At Deesa impure sand in the filters was suspected, and at Ahmednagar dirty water was found in the filters. In several cases, the specific microbe was reported to have been discovered in the water or other article. The medical officer at Kirkee complains that there was just as much enteric fever, though the milk supply is now so carefully supervised. The milk was suspected at four stations, and at one of them, Dagshai, the enteric bacillus is said to have been detected in it. As usual, the comparative immunity of women and children is given as a reason for not considering milk to be a frequent vehicle of the infection. For the period 1886–95 the enteric fever ratios per 1,000 of strength for India were as follows:—

	Admissions.	Deaths.
Men	19·6	5·28
Women	6·8	1·82
Children	3·5	0·69

The medical officer at Bangalore found by inquiry that only about 4 per cents of the men were drinkers of milk. The only reference to dust as an agent in the propagation of enteric fever is made in the Lucknow report, but only as a general surmise. The relative immunity of Calcutta, Murree, and Hyderabad (Sind) was ascribed to the excellent water supply, and, in the case of Murree, to careful sanitary supervision. Putting the bazar out of bounds was said to have been efficient in checking the disease at Nasirabad. A limited severe outbreak among officers at Bangalore was not traced to its source, but the sanitary condition and surroundings of their houses seem to have been bad. One of these officers suffered from his second attack of the disease. Out of the 1,870 cases of enteric fever which occurred throughout the army of India in 1895 about 30 are noticed as having declared themselves among patients in hospital or among attendants. Out of these 11 were in hospital for venereal diseases, 12 were in hospital for other diseases, and 7 were attendants on enteric fever cases.

There was an increase of both morbidity and mortality from enteric fever in 1895. As compared with the corresponding ratios of 1894, the admission and death ratios rose respectfully by 5·4 and 0·97 per 1,000 of strength. There were 1,870 admissions and 477 deaths, against 1,484, and 409 in 1894. The average number of men constantly sick from enteric fever was 220, and the average duration of a case was 52 days. The total loss of service due to the disease was about 80,216 days, men on field service being excluded from the calculation.

The following table shows a n increase in total fever mortality, which may be ascribed to the greater usefulness and less average length of service of the soldiers of to-day :—

	1870–79.			1881–90.†			1894.			1895.		
	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.	Enteric Fever.	Other Fevers.*	Total of both.
Army of India	2·03	1·42	3·45	3·79	·70	4·49	5·75	·56	6·31	6·72	·59	7·31

* Intermittent, remittent, and simple continued fevers.
† Excluding troops on active service in Burma during 1885 to 1887.

It shows in the years 1894 and 1895, as compared with the decennia, an increase of mortality from enteric fever, accompanied by a decrease in mortality from the other fevers, which is probably partly due to increased susceptibility to enteric fever on the part of the army, from youth and recent arrival, and partly to the increasing frequency with which the diagnosis of enteric fever has been made.

The following table shows enteric fever in the geographical groups in the decennium 1882–91, and in the last two years :—

Admissions per 1,000.

Period.	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	Indus Valley and North - Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts.
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XIIa.	XIIb.
1882–91	4·1	4·7	5·4	24·3	18·6	12·5	17·4	12·0	4.5	10·9	18·4	10·7
1894	2·6	5·3	7·6	23·8	27·2	21·1	32·6	19·8	4·1	13·4	25·1	19·2
1895	18·9	4·9	11·0	37·8	24·9	27·0	24·4	21·7	9·6	10·3	26·6	16·6

It shows that Groups V, VI, VIII, and XII*a*, especially, are apt to have high ratios of admission from enteric fever, and Groups I, II, and X low ratios. It also shows at a glance how the groups compare with each other in 1895, and how 1995 compares with 1894, or with the decennium. Group V had the highest ratio of 1895, and in it also the percentage of enteric fever in total admissions was greatest.

The distribution of enteric fever throughout the year by stations and months may be studied in Table VIII. But the following shows those garrisons which had an average strength of over 1,000 in 1895, with the decennial ratios for reference :—

Stations.	1895.		Decennium 1882–91.	
	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
Lucknow	56·2	15·36	32·7	5·62
Chakrata	52·0	15·69	15·1	4·85
Peshawar	49·2	16·80	10·4	4·33
Meerut	44·5	12 30	15·9	4·93
Umballa	40·9	80·9	10·6	2·49
Bareilly	35·7	4·12	34·2	8·67
Agra	31·1	14·75	13·9	4·46
Secunderabad	28·2	5·43	19·4	5·40
Poona	22·7	6·27	10·5	3·58
Rawalpindi	21·2	7·93	19·9	5·34
Wellington	19·4	5·28	5·7	1·95
Mhow	17·8	3·89	19·2	5·31
Quetta	11·9	2·55	14·0	3·67
Ranikhet	11·8	2·94	32·6	5·01
Rangoon	10·0	4·56	2.6	1·80
Ferozepore	9·3	4·63	11·8	3·85
Colaba	9·2	3·35	4·6	1·59
Bangalore	8·4	·93	18·1	3·66
Fort William	6·8	3·86	3·7	2·21
Kurrachee	4·9	1·64	22·4	4·06
Aden	4·8	3·85	2·0	1·25
Fort Dufferin	3·9	·97	8·1*	*3·10
Sialkot	0·8	·78	32·1	8·13

* (Four years).

The high position occupied by the decennial admission ratios of Bareilly, Lucknow, Ranikhet, and Sialkot will be observed, and the low position of the ratios of Aden, Calcutta, Bombay, and Rangoon. The enteric fever of stations may be studied with the aid of Tables III, IV, and VIII.

With regard to the relation of the mortality from enteric fever to age and length of residence in India, the results confirm those of former years. The ratio of mortality from enteric fever per 1,000 of strength was greatest in the age-period, 20-24 (8·22), and the relative liability of the same period was 47 per cent., that is the highest; the total number of deaths from enteric fever in that age-period was 293, and out of 100 deaths from all causes in that period 55 were from enteric fever; out of the total number that died at all ages from enteric fever 77 per cent. were between 20 and 24 years of age. Again, the ratio of mortality from enteric fever per 1,000 of strength was highest in the first year of residence in India (10·83), and the relative liability for the same period was 32 per cent., that is the highest; the total number of deaths from enteric fever in the first year was 141, and out of 100 deaths in the first year of residence, 59 were from enteric fever. Out of the total number that died at all periods of residence from enteric fever, 37 per cent. were in the first year of Indian residence.

The age-period 20–24 included 53 per cent. of the total strength of the army, and in the same period the liability to fall sick of enteric fever was greatest. In the succeeding three periods the liability gradually declined; but there was a slight rise again after 40, due, however, to only one admission. The greatest liability to get enteric fever was in the first year of Indian residence, and thereafter the liability rapidly declined. Since arrivals have increased, and since the percentage in the army of men under 25 years of age, and of men with less than five years' Indian residence has been gradually mounting, the admission ratio from enteric fever has also been rising. The greater has become the supply of susceptible material, the more the disease has prevailed.

Respiratory diseases. Notwithstanding the increase of influenza, respiratory diseases caused less sickness than in the preceding year. The admission rate fell from 34 per 1,000 in 1894 to 33 per 1,000 in 1895, and the death-rate from 0·98 to 0·57. The admission rate from pneumonia was 4·4 per 1,000, against 3·7; but the death-rate fell from 0·75 to 0·51.

Dysentery and diarrhœa. The admission and death-rates from dysentery were greatly, and those from diarrhœa somewhat increased, the former from 27 per 1,000 in 1894 to 35 per 1,000 in 1895, and the latter from 21 to 24 per 1,000. The death-rate from dysentery rose from 0·60 in 1894 to 1·04, and diarrhœa from 0·06 to 0·07. The increase was for the most part due to service in the Chitral campaign.

Hepatitis. Both the admission rate and the death-rate from hepatitis rose, the latter from 1·24 in 1894, to 1·45, of which 1·41 was due to abscess of liver.

Venereal disease. The admission rate from venereal disease was 522·3 against 511·4 in 1894. There were 3,164·84 against 3,062·18 men constantly sick in hospital from venereal disease, equivalent to over three regiments. The average stay of a case of veneral disease in hospital was 31·49 days against 30·77; and the total loss of service was about 1,155,167 days against 1,117,696; men in field service being excluded from the calculation. There were 15 deaths and 353 invalidings directly due to venereal disease. The highest ratios were at Nowgong, Cawnpore, and Indore; and the greatest increase of ratio at Cawnpore, Solon, Calicut, Mallapuram, and Poonamallee. The total venereal ratios of the commands may be compared in the table at page 44. In 34 stations the admission rate from secondary syphilis was over 100 per 1,000 of strength; and in 28 others it was over 75 per 1,000.

Statistics show clearly that the arrival year by year of fresh batches of young unmarried men under the short service system has been accompanied by an increase of venereal disease. Since 1878 the number of fresh troops arriving in the country has, as a rule, been much greater than before. The gradual rise in the percentage of men under 25 years of age in the army and of men under five years' Indian service has been pretty uniform, as has been the well-marked decline in the number of married men; and the same may be said of the gradual rise in the venereal ratio. As youth and recent arrival have become more common in the army, venereal disease and enteric fever have not unnaturally increased in frequency of occurrence.

An interesting pamphlet by Commenge gives comparative venereal statistics of the English, French and Russian armies, with some account of venereal disease in the Italian army. The following statistics, except the ratio of the Indian army, are from Bondesen:—

Venereal Admissions.

	1889–93. Ratio per 1,000.		1889–93. Ratio per 1,000.
Indian Army	453	French Army	44
English Army	212	Belgian Army	32
Italian Army	104	German Army	27 } about.
Austro-Hungarian Army	65	Danish Army	27 } about.

How far these ratios are trustworthy is not known in this office. An article has recently appeared, pointing out that in different countries the arrangements for the admission of cases is so different that a statistican, in instituting comparisons between the armies of two countries is, unless he is aware of these differences, and allows for them, sure to blunder. Perhaps it should also be borne in mind that the English army is not a conscript army. However, the above table is probably right in making the English ratios much higher than the others.

The following table shows the admission rate for venereal disease as far back as the records for India as a whole permit. The heading "primary syphilis" includes the local sore throughout:—

Venereal Disease in the Army of India.

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.
1872	61·2	22·4	179·0	1884	90·2	22·4	293·9
1873	53·4	20·4	166·7	1885	122·1	28·7	342·7*
1874	68·3	25·2	192·7	1886	157·9	33·3	389·5*
1875	67·1	25·1	205·1	1887	142·1	29·4	361·2*
1876	59·8	23·9	189·9	1888	142·1	32·4	370·6
1877	65·2	22·1	208·5	1889	225·1	51.2	481·5
1878	95·3	22·0	271·3	1890	220·7	66·3	503·5
1879	79·2	24·5	234·8	1891	159·2	60·0	400·7
1880	87·9	23·1	249·7	1892	161·1	57·8	409·9
1881	92·0	23·1	260·5	1893	213·6	61·6	466·0
1882	87·6	23·2	265·2	1894	248·1	74·6	511·4
1883	87·2	23·5	270·3	1895	239·0	84·9	522·3

* Including Troops on active service in Burma.

The figures in the above table show a more or less continuous rise in the incidence of venereal disease, more specially since 1885; and the increase in the ratio of secondary syphilis is of grave importance, more particularly with regard to the individual. No man who has not been effectually cured of syphilis can be reckoned upon as an efficient soldier; and the mischief is not confined to the individual, as the physical weaknesses are continued to succeeding generations.

33. The statistics for 1895 of the chief diseases having been examined, it will be interesting now to compare the mortality of the past five years from some of the principal causes with that of earlier periods:— Past and present mortality.

Died per 1,000 *of Strength.*

	India.		
	1891–95.	1881–90.	1870–79.
Enteric Fever	5·81	3·81	2·03
Cholera	1·38	1·46	3·22
Hepatitis	1·18	1·33	2·19
Dysentery	·65	·80	1·48
Phthisis pulmonalis	·58	·74	1·18
Respiratory diseases	·75	.59	·97
Remittent fever	·53	·52	1·28
Diarrhœa	·06	·09	·12
Total from all Causes	15·37	14·24	19·34

The increase in enteric fever and the decrease in hepatitis are probably due to the influence of the short service system, as is explained in page 42. The diminution of mortality from cholera, dysentery, and diarrhœa may perhaps be put down to improved hygiene. The rise in the total death rate is probably due to the number of military expeditions, and to three out of the five years having been bad cholera years in India. If the period had been 10 years the rise would in all likelihood have been obliterated, and perhaps changed into a fall.

Invaliding. In the whole army of India 1,763 men were invalided, or 24·82 per 1,000 of strength, against 1,808 and 25·43 in the preceding year. The ratio for the decennium 1881–90 was 27·35. In page 42 it is shown that invaliding has been reduced since the introduction of the short service system. The proportion of invalids to strength was lowest in the Punjab Command, highest in the Madras Command.

Thirty-three per cent. of the total number invalided were discharged as unfit for further service. The following table shows that this percentage was lower than it had been for some years:—

	Proportion Discharged.				
	1891.	1892.	1893.	1894.	1895.
India	34	40	39	39	33

The following table shows the diseases which accounted for invaliding of not less than 1 per 1,000 of strength:—

Intending Ratios per 1,000 *of Strength.*

Syphilis and Gonorrhœa	4·97
Malarial fevers	3·10
Debility	2·39
Circulatory diseases	1·93
Tubercle of the lungs	1·20

The ratio of invaliding from mental diseases decreased by a half. There were 24 cases of melancholia, 16 of dementia, and 12 of mania.

Invaliding according to age and Indian Service.—The percentage of men who were invalided while under 25 years of age to the whole number invalided was 66 against 60. The percentage of men under 25 in the strength of the army was 55 against 54.

Of the total number of men invalided 36 per cent. were of less than two years' service, and 86 per cent. were of less than five years' service. With this is to be considered the fact that 83 per cent. of all the men in the strength of the army were of less than five years' service.

With regard to individual diseases. The highest invaliding ratio per 1,000 of strength from venereal disease was in the age-period 20·24, and the relative liability for that period was 32 per cent.; the total number invalided for venereal disease in the same age-period was 222, and of 100 invalidings in the age-period 21 were due to venereal disease; of the total number invalided for venereal diseases at all ages 63 per cent. were in that age-period. Again, the highest ratio of invaliding for venereal disease was in the fourth year of Indian service, and the relative liability in that year was 20 per cent.; the total number invalided for venereal disease in the fourth year was 75, and of 100 invalided in the fourth year 26 were due to venereal disease; of the total number invalided for venereal diseases at all periods of residence 21 per cent. were in the fourth year.

Statistics of Officers. The vital statistics of officers show that the death-rate for *all* officers in the British Army was 11·10, and that for the Indian Army 9·62. Enteric fever caused more deaths among the British than among the Indian officers, apparently because Indian officers have to serve first with British regiments, and it is known that youthful and newly arrived men are more liable to take the disease than others.

Sickness among women decreased, but the mortality was higher. The constantly sick-rate, though reduced, was still somewhat high:— Statistics of women.

Period.	Average annual strength.	Admission-rate per 1,000.	Constantly sick-rate per 1,000.	Death-rate per 1,000.
1881–90	3,352	837·5	30·6	18·86
1894	3,157	926·8	41·1	14·57
1895	3,194	804·3	35·2	17·85

The chief causes of admission were debility, ague, and the diseases peculiar to women. Among the diseases which caused increased admissions were small-pox, enteric fever, pneumonia and dysentery; while from influenza, cholera, and ague admission was lessened. Debility caused 34 per cent. of the total sickness, and ague 19 per cent.

The chief causes of death were puerperal affections, enteric fever, remittent fever, tubercle of the lungs, and pneumonia. Among the diseases which gave much increased mortality were small-pox, enteric fever, pneumonia, dysentery, and puerperal affections. Mortality from cholera and diarrhœa was diminished. Puerperal affections caused 18 per cent. of the total deaths, and enteric fever 14 per cent.

That both sickness and mortality among children were lowered in 1895 is seen in the following table:— Statistics of children.

Period.	Average annual Strength.	Admission-rate per 1,000.	Constantly sick-rate per 1,000.	Death-rate per 1,000.
1881–90	6,286	633·5	23·4	50·22
1894	5,680	732·2	32·6	44·89
1895	5,699	598·5	26·2	41·24

The chief causes of admission were ague, respiratory diseases, and diarrhœa. Among the diseases with raised admission-rates were enteric fever, cholera, and smallpox; while admission from influenza, measles, respiratory diseases, and eye diseases was lessened. Ague caused 20 per cent. of the total sickness, and respiratory diseases 15 per cent.

The chief causes of death were debility (including immaturity at birth), diarrhœa, convulsions, and teething. Among the diseases from which there was increased mortality were cholera, small-pox, diphtheria, ague and remittent fever. Mortality from enteric fever, respiratory diseases, and convulsions was diminished. Debility caused 15 per cent. of the total deaths, diarrhœa 14 per cent., convulsions 12 per cent., and teething 11 per cent.

Native Troops.

There was less sickness among the Native troops in 1895 than in the preceding year; malaria, influenza, and cholera being less prevalent. The rise in the general death-rate, and in particular the rise in the death-rate from pneumonia, were due to exposure and hardship incidental to the Waziristan and Chitral expeditions. Sickness and mortality in 1895.

Year.	Average Strength.	Ratio per 1,000.							
		Admissions into Hospital.	Constantly Sick.	Deaths from					Mortality, including absent Deaths.
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All Causes.	
1882–91	118,111	1,020	34	1·45	1·47	2·90	·77	13·09	16·61
1894	127,844	897	31	·56	1·44	2·87	·51	10·76	13·59
1895	129,655	794	30	·41	1·20	4·20	·53	11·60	15·71

The chief causes of admission were ague, bowel complaints, and respiratory diseases. Among the diseases with raised admission rates were pneumonia, tubercle of the

lungs, dysentery, diarrhœa, and scurvy. Among those with lessened rates were influenza, cholera, ague, simple continued fever, respiratory diseases other than pneumonia, and venereal diseases. Ague caused 36 per cent. of the total admissions.

The chief causes of death were pneumonia and remittent fever. Among the diseases which caused increased mortality were small-pox, tubercle of the lungs, and pneumonia. Among those from which mortality was lessened were cholera, remittent fever, circulatory diseases, and respiratory diseases other than pneumonia. Pneumonia caused 36 per cent. of the total deaths, and remittent fever 10 per cent.

The total number invalided for discharge was 1,875, and the chief causes of invaliding were debility, ague, respiratory diseases, and venereal diseases.

If the following table be compared with that at page 44, it will be seen how much less the Native soldier suffered from enteric fever, simple continued fever, ague, tubercle of the lungs, diarrhœa, hepatitis, venereal diseases; and much more from remittent fever, small-pox, pneumonia, other respiratory diseases, and dysentery than his European comrade. These relations are unusual with regard to ague, but usual in the case of enteric fever, remittent fever, respiratory diseases, dysentery, hepatitis, and venereal diseases.

Ratios of Commands.

—	Ratio per 1,000 of the Average Strength.						
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Central India and Rajputana Corps.	Hyderabad Conitngent.	Army of India.*
I.—Average Annual Strength	24,454	41,062	26,738	25,259	5,172	6,968	129,655
II.—Constantly Sick-rate of the Year.	30·3	33·2	29·6	28·4	20·8	22·0	29·9
III.—Admission-rate of the Year:—							
Influenza	3·1	8·1	1·4	18·2	1·0	—	7·0
Cholera	·6	—	1·0	·9	·8	1·0	·6
Small-pox	·5	·6	·4	·8	·6	·1	·5
Enteric fever	·3	·1	·1	·2	—	—	·2
Intermittent fever	288·5	307·6	225·3	346·8	182·1	281·0	287·3
Remittent fever	16·7	22·5	4·4	19·5	17·4	12·3	16·4
Simple continued fever	6·7	4·3	23·3	15·6	10·4	4·6	11·2
Tubercle of the lungs	4·2	2·6	1·3	1·3	3·1	1·3	2·3
Pneumonia	9·5	30·8	6·4	17·1	20·9	9·3	17·5
Other respiratory diseases	26·6	49·9	20·8	43·1	35·0	13·5	35·6
Dysentery	42·9	76·0	29·2	43·5	15·7	25·4	48·6
Diarrhœa	12·9	18·1	11·5	13·2	8·1	2·6	13·6
Hepatic abscess	—	—	·1	·1	·2	—	·1
„ congestion and inflammation.	1·3	·9	1·2	1·5	1·5	·4	1·1
Scurvy	·6	5·7	·4	9·9	·6	1·1	4·0
Venereal diseases	32·3	25·6	38·7	37·9	14·5	21·4	31·3
All Causes	790·2	878·2	660·2	889·2	595·1	617·4	793·5
IV.—Death-rate of the Year:—							
Cholera	·49	—	·75	·44	·77	·86	·41
Small-pox	·04	·07	·04	·12	—	—	·06
Enteric fever	·20	·05	—	·08	—	—	·07
Intermittent fever	·45	·71	·82	·44	·19	·43	·59
Remittent fever	·70	2·24	·64	·83	·77	·72	1·20
Simple continued fever	·04	—	·07	—	—	—	·02
Circulatory diseases	·08	·10	·52	·24	·58	·57	·25
Tubercle of the lungs	1·02	·88	·37	·44	·19	·57	·67
Pneumonia	1·43	8·33	1·38	4·39	2·32	1·00	4·20
Other respiratory diseases	·41	1·17	·19	·83	·19	·29	·67
Dysentery	·53	·78	·34	·44	·39	·29	·53
Diarrhœa	·29	·29	·22	·12	·39	—	·23
Hepatic abscess	·04	—	·04	·04	—	—	·02
Anæmia and debility	·20	·39	·49	·36	·19	·14	·35
All Causes	8·26	17·58	8·38	11·12	6·77	5·74	11·60

* For complete detail of diseases, *see* Table XXIX.

Of the commands the Punjab was the most unhealthy, having the highest constantly sick and death rates. That this command suffered the most from remittent fever, pneumonia, and other respiratory diseases, dysentery, and diarrhœa was due to the

Waziristan and Chitral expeditions. The Bombay Command, which had the highest admission-rate, was the worst of the commands as regards admissions from influenza, ague, and scurvy.

The following table shows the statistics of all the native troops serving in Burma and the Andamans. Of these troops in 1895 about 99 per cent. belonged to the Madras Army:—

Years.	Average Annual Strength present.	Ratio per 1,000.						
		Admissions into Hospital.	Constantly Sick.	Deaths from				
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All Causes.
1890	10,353	1,510	69	5·02	5·31	1·84	4·15	38·83
1891	11,401	1,676	76	1·75	2·98	1·84	4·03	36·31
1892	11,333	1,349	57	2·29	2·29	2·29	3·09	29·12
1893	10,326	1,092	48	·87	1·45	2·42	1·36	19·85
1894	10,500	809	35	1·43	·95	1·14	1·43	13·90
1895	9,952	827	37	·80	·50	·80	·80	10·55

The table shows that the death-rate has been reduced year by year. Sickness was not high, though higher than in the previous year.

The table which follows shows that both for the decennium and in 1895 Groups II, III, IV, VII, and XII, had high constantly sick ratios; and that both for the decennium and in 1895 mortality from respiratory diseases was greatest in the Indus Valley and in the Hills. Geographical groups.

	Ratio per 1,000 of Strength.											
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.
	Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	Indus Valley and North - Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	India.
1882–91 Constantly sick rate	50·1	74·6	54·2	47·2	32·2	31·9	37·8	28·5	27·4	22·3	26·1	43·4	34·1
1882–91 Death-rates from— Cholera	—	7·35	·87	1·36	·91	·61	·53	·67	1·11	·24	2·03	1·49	1·45
1882–91 Death-rates from— Respiratory diseases	·96	1·88	1·59	1·73	1·97	3·65	6·66	2·68	1·50	1·00	1·23	6·61	3 41
1894 Constantly sick rate	37·2	38·9	44·7	40·1	27·0	30·1	38·1	29·2	28·7	31·9	24·7	38·6	31·2
1894 Death-rates from— Cholera	—	2·15	—	—	2·15	—	·07	·07	1·38	·66	·34	—	·56
1894 Death-rates from— Respiratory diseases	·96	2·57	2·84	2·12	1·29	4·36	7·55	2·41	1·68	·66	1·46	5·59	3·63
1895 Constantly sick rate	24·4	42.9	39·1	37·0	23·1	29·9	35·3	24·4	26·8	29·8	26·1	37·1	29·9
1895 Death-rates from— Cholera	—	1·20	—	—	1·69	—	—	·69	·77	—	·99	—	·41
1895 Death-rates from— Respiratory diseases	1·87	·75	2·66	·99	1·23	4·60	12·48	3·21	2·17	·65	1·32	5·97	4·87

Burma Coast had the lowest admission ratios from ague and tubercle of the lungs; Burma Island the highest from cholera and ague, and the lowest from pneumonia; Assam the highest from remittent fever, tubercle of the lungs, and diarrhœa; Bengal-Orissa the highest from dysentery, and the lowest from simple continued fever; the Indus Valley the highest from pneumonia and other respiratory diseases; Central India the lowest from dysentery; Southern India the highest from simple continued fever, and the lowest from remittent fever, respiratory diseases other than pneumonia and diarrhœa; and the Hill stations the highest from influenza and scurvy. Assam and the Hills, where the Gurkhas, who are foreigners, are stationed, had the highest venereal ratios.

Of the large stations throughout India with a strength of not less than 1,000 the following returned the highest death-rates:—Dehra Dun, 20·78; Kohat, 22·67; Edwardesabad, 36·06; Dera Ismail Khan, 19·13; Dera Ghazi Khan, 23·15; Dharmsala, 20·97.

In Dehra Dun and Dharmsala, which are garrisoned by Gurkhas, tubercle of the lungs was the chief cause of death; and in the other four, which are frontier stations, pneumonia was the chief cause.

Principal diseases: Influenza.

Attention having been directed to the health statistics of India, of the commands, of the geographical groups, of stations, and of regiments, it will be convenient now to consider some of the chief diseases. Influenza decreased, there having been 910 cases, 7·0 per 1,000 of strength, against 1,155 cases, 9·0 per 1,000 of strength, in the preceding year. The number of stations affected was 22 against 37, 10 of those attacked in 1895 having also suffered in 1894. The geographical groups affected in both years were IV, V, VI, VII, VIII, IX, XI, XII, and Extra India. Groups I, II, and III were not affected either in 1894 or in 1895. In proportion to strength the Hills was the group most severely affected; whilst the greatest numbers of cases occurred in the Hills and in the Indus Valley.

The following table shows the monthly progress of the disease since the beginning of 1890. The maximum month varied from year to year; but over the period as a whole most cases occurred in April and March, and fewest cases in October and September:—

Influenza.

Years.	Number of Admissions into Hospital in each Month.												Total.
	Jan.	Feb.	March.	April.	May.	June	July.	August.	Sept.	Oct.	Nov.	Dec.	
1890	1	8	2,460	5,118	492	82	55	—	—	—	1	—	8,217
1891	—	—	1	—	105	259	123	106	51	22	17	215	899
1892	681	371	511	149	40	5	5	7	—	1	7	18	1,795
1893	8	28	65	99	95	13	9	7	—	3	53	404	784
1894	159	203	232	384	143	11	5	—	1	1	5	11	1,155
1895	26	28	53	76	110	25	60	57	19	17	31	408	910
Total	875	638	3,322	5,826	985	395	257	177	71	44	114	1,056	13,760

The greatest numbers of cases occurred at Chaman, Abbottabad, and Dera Ghazi Khan. At the first named station the disease lasted throughout the year, but in the other two it was confined to December. The following table shows that in 1895 the Native troops were somewhat less severely affected than the European troops, much less severely than the prisoners:—

Years.	Per 1,000 of Average Strength.											
	Influenza.						Pneumonia.					
	European Troops.		Native Troops.		Prisoners.		European Troops.		Native Troops.		Prisoners.	
	Admission.	Death.	Admission.	Death.	Admission.	Death.	Admission.	Death.	Admission.	Death.	Admission.	Death.
1890	33·4	·03	64·3	·41	78·6	·67	4·6	·90	16·7	3·96	18·5	5·71
1891	5·5	·04	7·0	·09	19·0	·29	2·6	·54	11·6	2·53	17·0	4·87
1892	12·7	·01	14·1	·15	56·7	1·26	3·5	·62	13·6	3·26	18·4	5·56
1893	·3	—	6·2	·20	6·4	·09	3·4	·70	12·3	2·75	15·9	3·95
1894	3·4	·01	9·0	·16	41·0	·43	3·7	·75	12·9	2·87	15·4	4·31
1895	7·8	·03	7·0	·08	20·3	·15	4·4	·51	17·5	4·20	16·4	4·00

It also shows how the death-rate from pneumonia has fluctunted year by year with the admission-rate from influenza. It has already been explained that the unusually high death-rate from pneumonia in 1895 was the result of service in Waziristan and Chitral.

Cholera.

There were 75 cases of cholera with 53 deaths against 116 with 71 in the preceding year. The admission-rate per 1,000 was 0·6 against 0·9, and the death ratio 0·41 against 0·56. Cases occurred in every month except March, the maximum months being July, September, and November. In Burma Inland the cases bore the highest

proportion to strength. The greatest numbers of cases occurred in the Deccan and in Burma Inland. Among stations Malegaon, Fort Dufferin, and Fyzabad had most cases, but 11 was the highest number of cases at any one station. The circumstances attending the chief outbreaks will be discussed, so far as they are of etiological importance, in the section History of Chief Diseases.

To ague was due 36 per cent. of the sickness of the Native army. The admission-rate from ague fell considerably in 1895. In 1895 Burma Inland was the most malarious group, and Burma Coast the least malarious. The most malarious month was October, the least malarious March. Remittent fever caused 10 per cent. of the total deaths, and it was at its maximum in August. Judging from the frequent discrepancy between diagnosis and *post mortem* record in the case of prisoners, it is not improbable that among native troops also the fevers returned as remittent are not all malarial but include some cases of fever due to organic disease. Fevers.

The ratio of admission from enteric fever in the Native army in 1895 was 0·2 per 1,000, and the death-rate 0·07, against 0·3 and 0·05 in the previous year. The corresponding decennial ratios of 1882–91 are 0·3 and 0·09. The following table shows that the ratios for European troops are very unlike those for Native troops and prisoners :—

	1882–1891.		1895.	
	Admissions.	Deaths.	Admissions.	Deaths.
European troops	14·7	4·13	26·3	6·72
Native troops	·3	·09	·2	·07
Prisoners	·2	·10	·4	·13

Post mortems are rarely obtainable in the case of Native soldiers; but among prisoners nearly every fatal case of disease is subjected to *post mortem* examination. Under these circumstances the fact that the ratios of prisoners and sepoys for a 10-year period are practically identical appears to show that the Native troops really suffer less than the European; though it does not show that there may not be more cases of enteric fever among both Native troops and prisoners than are at present diagnosed during life or after death. Again, the following table shows that the fever mortality in the European army is not the same in amount, which indicates that the difference is not altogether a mere matter of diagnosis :—

Causes of Death.	Died per 1,000 of Average Strength.		Relative Liability in Percentages.			Percentage in Deaths from all Causes.	
	European Troops.	Native Troops.	European Troops.	Native Troops.	Total=100.	European Troops.	Native Troops.
Ague	·25	·59	30	70	100	1·7	5·1
Remittent fever	·30	1·20	20	80	100	1·9	10·4
Simple continued fever	·04	·02	67	33	100	·3	·2
Enteric fever	6·72	·07	99	·1	100	44·0	·6
Total	7·31	1·88	80	20	100	47·9	16·3

The total fever mortality among the Native troops in 1894 was to the total fever mortality among European troops as 1 : 3·9. For the period 1886–91 the corresponding ratio was 1 : 1·9, and for 1894 it was 1 : 3·0. Again, among European troops 48 per cent. of all deaths in 1895 were from fevers; only 16 per cent. among Native troops. It appears, then, that Native soldiers and prisoners are less liable to enteric fever than Europeans are.

The question of the immunity, or apparent immunity, of natives of India as regards enteric fever has been frequently discussed in former reports. At page 33 of the Report for 1890 was noticed the suggestion that it was the fact of coming from comparatively pure England that made the modern English soldier so liable to contract enteric fever in India, while the natives of India having lived for generations in specific

filth, had acquired a certain tolerance or immunity; the difference of the behaviour of measles in England and in Fiji being adduced as an illustrative parallel example. The same view is prominently brought forward in the *Indian Medical Gazette* for August 1896, page 294, in a review of Mr. Archdale Reid's "The Present Evolution of Man." This interesting article concludes as follows:—

> The fact that many medical men believe that enteric fever is really prevalent among native *children*, though often called by other names, is an argument for rather than against this view; for, just as in biology, a trait which appears late in the ontogeny corresponds to a trait which appeared late in the phylogeny, so the power of resisting the germs of enteric fever must have appeared late in the Indian races, that is, after generations of exposure to it and consequent survival of the fittest. Therefore, this power will appear late in the individual, so that children are still liable to be attacked.

In the whole Native army of India 22 cases with 9 deaths were returned as enteric fever, against 33 cases with 6 deaths in 1894. In only two cases were *post mortems* obtained; and the lesions described support the diagnosis.

Respiratory diseases.

The ratio of admission remaining the same, the death ratio from respiratory diseases rose:—

Period.	Ratio per 1,000 of Strength.			
	Respiratory Diseases.		Pneumonia.	
	Admissions.	Deaths.	Admissions.	Deaths.
1886–95	50	3·75	13	3·02
1894	53	3·63	13	2·87
1895	53	4·87	18	4·20

Respiratory diseases are the chief cause of death in the Native army, and in 1895 no less than 42 per cent. of all deaths were due to them. For respiratory diseases other than pneumonia the highest admission ratios were those of Indus Valley, Central India, Burma Coast, and the Hills, and the lowest that of Southern India. The highest death-rate was that of Assam, while there were no deaths from those diseases in Burma Inland and Western Coast.

Pneumonia.

The table given in the preceding paragraph shows that the admission and death-rates rose much. This, as has already been explained, was due to the exposure endured by the regiments on active service in Waziristan and Chitral. The admission and death ratios were highest in the Indus Valley and the Hills, and the percentage of pneumonia to total deaths was there also highest. Both in the Indus Valley and in the Hills pneumonia was most prevalent in the cold months; and the same was the case for India as a whole.

Pneumonia has been shown separately in the tables of this Report only from 1889; that is why the period 1889–95 has been adopted in the following:—

Pneumonia, 1889–95.

——	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Ratio per 1,000.	
														Admitted.	Died.
European troops	255	180	183	186	117	69	66	55	53	89	170	296	1,719	3·5	·64
Native troops	2,358	1,667	1,310	911	465	337	345	252	308	667	1,384	2,871	12,375	13·8	3·18
Prisoners	1,717	1,368	1,181	914	728	584	609	532	639	857	1,138	1,676	11,943	16·9	4·75

The Europeans suffered much less than the Natives, probably because they are more accustomed to cold, because they are better clothed, and because they are more nutritiously fed. The high ratios among prisoners indicate the necessity for increased attention to ventilation, to clothing, and to the prevention of scurvy and malaria. Throughout the period the ratios of prisoners have been higher than those of Native troops, except in the year 1895, in which the Native troops were campaigning in Waziristan and Chitral. The table also shows that the coldest months had most

pneumonia, January and December being the maximum months for all three bodies of men. Group VI, VII, VIII, and XII, which in the following table show the highest ratios, also have the maximum in January and December; and these are groups which have a marked cold weather, a great range of temperature between day and night in the cold weather, and, generally, high ratios of admission from malaria or scurvy, or both. Again, of the 11 stations of European troops that had the highest ratios from pneumonia during the period, three belonged to Group VI, three to Group VII, and five to Group XII; of the 15 stations of Native troops with the highest ratios, two belonged to Group VI, nine to Group VII, two to Group VIII, and two to Group XII; of the 23 jails with the highest ratios, two belonged to Group IV, two to Group V, 10 to Group VI, seven to Group VII, one to Group VIII, and one to Group IX; or, taking all the worst stations and jails together, 31 per cent. belonged to Group VI, 39 per cent. to Group VII, and 14 per cent. to Group XII. Rawal Pindi, with its maximum in January and December, and Quetta with its maximum in March and November, had the highest pneumonia admission ratios for European troops; Edwardesbad with its maximum in January and December, the highest for Native troops; and Shikarpur with its maximum in January, February, November, December, the highest for prisoners:—

Pneumonia, 1891–95.

Ratio per 100.

	Burma Coast and Bay Islands.		Burma Inland.		Assam.		Bengal and Orissa.		Gangetic Plain and Chutia Nagpur.		Upper Sub-Himalayan.		Indus Valley and North-West Rajputana.	
	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.
European troops	2·7	·30	1·2	·31	—	—	1·5	·27	1·7	·33	5·4	·86	6·3	1·22
Native troops	6·9	1·57	5·9	1·61	9·3	2·26	5·2	·67	6·2	1·29	14·4	3·96	29·5	7·76
Prisoners	5·5	2·13	12·3	3·50	10·3	4·22	18·1	4·47	15·3	3·90	29·5	6·85	44·5	13·97

	South-East Rajputana. Central India and Gujarat.		Decca.		Western Coast.		Southern India.		Hill Stations.		Hill Convalescent Depôts.		India.	
	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.
European troops	1·7	·26	2·0	·23	1·6	·13	2·5	·49	4·8	1·01	4·0	1·45	3·5	·62
Native troops	10·6	1.70	8·2	1·43	4·6	·55	8·0	1·44	18·7	4·26	—	—	13·6	3·12
Prisoners	23·7	5·64	13·3	3·96	7·8	2·56	6·3	2·10	15·6	4·92	—	—	16·6	4·54

Among medical officers of Native regiments on the frontier the opinion is prevalent that the pneumonia occurring there is often of a very infectious type; but it is at the same time acknowledged that malaria-saturated or scurvy-tainted men exposed to chill are peculiarly vulnerable. Similar conditions among the prisoners in the jails of the Punjab often tend to the same result.

From what has been brought forward in this paragraph it seems probable that in all the three bodies of men pneumonia is to a considerable extent a preventable disease; and that it might, with some success, be combated by free ventilation, without draughts, so as to diminish the risk of infection; by suitable clothing at all times, but especially by the use of extra warm clothing, such as a jersey, from sundown in the cold weather; by a sufficiency of food with good vegetables and antiscorbutics; and by the prophylactic issue of antiperiodics. Of course, there are difficulties in the way of carrying out these measures thoroughly, especially in the case of the Native troops; but probably more could be done than has hitherto been attempted. In any case it is proper to point out what ought to be striven after.

Dysentery.

From dysentry, the admission and death-rates were somewhat higher than in the preceding year. The highest admission-rates were in the Punjab Command, and in the Bengal-Orissa group. The death-rate of Native troops from dysentery was to that of the Europeans as 1 : 1·96 ; and the percentage of dysentery in total cases of death was 4·6 in the case of Native troops, and 6·8 in the case of European troops. The admission rate of Native troops, however, was much higher than that of European troops, 48·6 to 35·5.

Venereal diseases.

The following table is given to compare with the corresponding one in the section on European troops, page 55 :—

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.
1877	11·5	5·3	26·7	1887	12·6	6·1	27·4
1878	16·3	5·8	37·5	1888	13·5	5·4	31·5
1879	16·5	7·0	37·1	1889	16·6	6·4	38·9
1880	15·0	5·8	33·3	1890	16·0	6·9	41·1
1881	17·9	7·2	39·5	1891	13·6	6·9	37·9
1882	14·7	5·9	34·4	1892	14·1	7·9	39·6
1883	13·0	6·5	31·6	1893	13·3	9·0	36·4
1884	11·0	5·3	27·9	1894	13·8	8·2	32·3
1885	11·2	5·9	30·1	1895	13·1	7·3	41·3
1886	13·7	6·0	28·1				

The figures for India are not available for the years before 1877. All the venereal ratios of Native troops run at a much lower level than those of European troops; and there is not the same tendency to increase in the ratios of the former as in those of the latter, there having been no change in the Native army corresponding to the introduction of the short service system in the European army.

A comparison of the tables will show that the lowest ratios for both European and Native troops were those of the Punjab Command; the highest for European troops the Bengal Command, and the highest for Native troops the Madras Command. In all the commands the ratios of Native troops were much lower than those of European troops. Among the European troops of India there were 522 admissions for every 1,000 men, among the Native troops only 31.

The admission-rate for India was exactly 1 per 1,000 less than in 1894. There were six deaths and 86 invalidings attributed directly to venereal disease.

Those Native troops that are serving in regions farthest away from their homes appear to be the most affected by venereal disease. The Gurkhas are the most conspicuous example of this.

Finally, the following table of death ratios is given to show how the past five-year period compares with the decennium immediately preceding it :—

Died per 1,000 *of Strength.*

Diseases.	Army of India.	
	1891–95.	1881–90.
Cholera	1·19	1·28
Enteric fever	·08	·08
Ague	·84	·66
Remittent and simple continued fevers	1·40	1·45
Phthisis pulmonalis	·68	·67
Respiratory diseases	3·85	3·84
Dysentery	·67	·81
Diarrhœa	·34	·65
Scurvy	·04	·13
Anæmia and Debility	·48	·65
All causes	12·61	13·44

The total death-rate has been reduced; and in the case of the diseases shown the reductions are greater in amount than the increases, as well as greater in number.

Jails.

Sickness and mortality in 1895.

The year 1895 was one of much sickness, though the death-rate was considerably reduced. The weather of the whole year was less disturbed than usual, and the most noteworthy feature of the monsoon rains was the general deficiency over the whole of India north of lat. 18. Among the free population influenza, cholera, and malaria appear to have been less prevalent than in the preceding year.

Year.	Average Annual Strength.	Ratio per 1,000.									
		Admissions into Hospital.	Constantly Sick.	Deaths from							
				Cholera.	Remittent fever.	Dysentery.	Diarrhœa.	Respiratory diseases.	‡Phthisis Pulmonalis.	Anæmia and Debility.	All Causes.
1882–91* - -	89,642	1,093	38	2·91	1·60	6·84	3·93	5·99†	2·37	2·16	33·61
1894* - -	101,965	1,077	41	2·27	1·23	6·95	2·76	5·65	2·91	2·13	31·87
1895* - -	106,337	1,082	44	·80	1·20	7·15	2·31	5·14	2·54	1·49	27·61

* Excluding subsidiary jails. † From 1886. ‡ Tubercle, Pneumonic Phthisis and Hæmoptysis.

The chief causes of admission to hospital were ague, dysentery, abscess, and diarrhœa. Among the diseases with raised admission-rates were simple continued fever, tubercle of the lungs, pneumonia, dysentery, debility, and abscess. Ague caused 35 per cent. of the total sickness, and bowel complaints 16 per cent.

The chief causes of death were dysentery, pneumonia, tubercle of the lungs, diarrhœa, and debility. Among the diseases with mortality lessened in 1895 were cholera, respiratory diseases, debility, and diarrhœa. Dysentery caused 26 per cent. of the total deaths, and pneumonia 14 per cent.

The following statement shows for each administration, except the Andamans, the proportion of prisoners in 10,000 of the population. Some of the prisoners of each province have been transported to the Andamans, and these are necessarily excluded from the calculation; so that the ratios are all somewhat too low:—

Ratio of prisoners per 10,000 *of population in each of nine administrations for* 1894 *and* 1895 (*Andamans excluded*).

Administrations.	Period.	General Population, according to Census of 1891.	Prisoners.		
			Average Number.*	Proportion per 10,000 of Population.	Deaths per 1,000 of Average Strength.*
Burma - - - -	1894	7,605,560	12,644	16·6	28·87
	1895		13,666	18·0	17·93
Assam - - - -	1894	5,476,833	1,496	2·7	50·80
	1895		1,436	2·6	59·19
Bengal - - - -	1894	71,346,987	17,341	2·4	47·11
	1895		16,926	2·4	27·53
N.-W. Provinces and Oudh -	1894	46,905,085	27,958	6·0	32·26
	1895		31,604	6·7	28·38
Punjab - - -	1894	20,866,847	11,444	5·5	18·52
	1895		11,565	5·5	21·62
Bombay - - - -	1894	18,901,123	8,135	4·3	32·08
	1895		8,382	4·4	29·23
Berar - - -	1894	2,897,491	1,367	4·7	27·80
	1895		1,424	4·9	23·88
Central Provinces - -	1894	10,784,294	4,503	4·2	31·76
	1895		4,951	4·6	55·95
Madras - - - - -	1894	35,630,440	10,025	2·8	19·85
	1895		9,790	2·7	18·19

* Including subsidiary jails. The death-rates of the free population are given in the appendix to Section V.

The following table compares the ten administrations with each other, and the present of each administration with the past:—

—	Years.	Average Annual Strength.	Ratio per 1,000.* Admissions.	Constantly Sick.	Deaths from*: Cholera.	Remittent fever.	Dysentery.	Diarrhœa.	Respiratory diseases.	‡Phthisis Pulmonalis.	Anæmia and Debility.	All Causes.
Andamans	1882–91	11,801	1,739	61	—	3·11	4·86	2·52	3·78†	4·31	1·43	23·72
	1894	10,419	1,463	55	—	4·42	5·28	4·13	2·88	2·40	5·57	30·71
	1895	10,259	1,648	52	—	5·26	8·19	4·48	1·95	2·53	3·51	31·09
Burma	1882–91	8,339	983	41	7·78	1·32	9·79	2·91	4·15†	2·58	3·26	42·09
	1894	12,644	876	42	3·72	·87	5·46	1·90	2·61	3·24	·55	28·87
	1895	13,666	891	38	1·17	·88	3·37	·73	2·20	3·22	·29	17·93
Assam	1882–91	1,201	1,978	58	5·41	1·92	13·58	6·58	5·65†	1·00	4·08	48·06
	1894	1,263	1,374	60	—	·79	13·46	11·88	3·17	1·58	7·13	57·01
	1895	1,200	1,262	64	1·67	—	17·50	12·50	5·00	2·50	5·00	66·67
Bengal	1882–91	13,984	1,373	47	5·65	1·95	13·62	5·46	4·68†	3·58	2·21	46·14
	1894	16,514	1,192	44	4·42	1·39	16·41	3·39	5·27	5·45	2·48	47·60
	1895	16,103	1,211	43	1·74	1·06	8·14	1·80	3·23	3·10	·99	26·95
North-Western Provinces and Oudh.	1882–91	22,617	727	29	1·67	·82	4·90	2·55	6·37†	1·83	2·01	25·62
	1894	27,735	847	43	3·32	·61	6·38	2·88	6·02	2·38	2·38	32·16
	1895	31,296	914	57	·32	·35	8·21	2·30	6·01	1·92	2·01	28·31
Punjab	1882–91	11,935	1,370	33	1·29	1·52	4·15	3·46	11·50†	1·58	1·05	31·91
	1894	11,308	1,754	40	—	·80	2·92	·97	6·54	1·86	·27	18·66
	1895	11,415	1,446	35	—	·44	2·10	·35	9·29	2·72	·26	21·73
Bombay	1882–91	6,916	698	25	1·43	2·62	3·15	3·76	8·51†	1·55	2·07	31·18
	1894	7,256	828	31	1·38	·83	2·76	3·17	13·09	2·48	1·93	33·21
	1895	7,212	1,010	33	·69	1·25	5·27	4·99	8·73	3·33	1·25	31·89
Berar	1882–91	1,048	571	14	·86	1·34	·76	1·14	2·59†	1·43	·57	14·21
	1894	1,367	1,326	50	—	·73	3·66	1·46	11·70	1·46	·73	27·80
	1895	1,424	876	23	—	1·40	2·81	·70	6·32	1·40	2·11	23·88
Central Provinces	1882–91	3,998	954	33	5·15	1·65	12·73	11·88	5·91†	1·15	5·10	52·87
	1894	4,503	951	34	·44	·44	6·44	3·55	6·00	2·67	1·33	31·76
	1895	4,951	922	35	3·03	1·41	23·03	6·46	7·08	2·83	3·23	55·95
Madras	1882–91	7,333	748	27	3·44	·42	4·35	5·50	2·63†	1·62	2·73	28·79
	1894	8,556	735	27	1·05	1·05	3·74	1·29	3·27	2·33	1·40	20·45
	1895	8,418	746	28	1·07	·36	4·87	·12	3·20	1·90	·24	19·60

* Excluding subsidiary jails. † From 1886. ‡ Tubercle, Pneumonic Phthisis and Hæmoptysis.

The prisoners of the Andamans, Assam, the North-Western Provinces and Oudh, Bombay, the Central Provinces, and Madras were more unhealthy than in the previous year; those of the last only slightly so.

In 1895 the three most unhealthy administrations were, in order, Assam, the Andamans, and the North-Western Provinces and Oudh; and the three most healthy were, in order, Madras, Berar, and Burma.

As compared with the decennial ratios, cholera mortality was reduced in all the administrations; dysentery mortality in Burma, Bengal, and the Punjab; dysentery and diarrhœa mortalities were increased in the Andamans, Assam, and Bombay; diarrhœa mortality was much* diminished, and dysentery mortality slightly increased in Madras. Mortality from respiratory diseases was increased in Bombay, Berar, the Central Provinces, and Madras; phthisis mortality rose in Burma, Assam, the North-Western Provinces and Oudh, the Punjab, Bombay, the Central Provinces, and Madras; and the total mortality increased in the Andamans, Assam, the North-Western Provinces and Oudh, Bombay, Berar, and the Central Provinces.

The great differences between the death-rates of the different administrations, as shown in the above table, are most striking. A uniform death-rate among jails distributed over such a wide geographical area, and placed under such different permanent climatic conditions, and frequently under such different temporary weather conditions (drought in one, excessive rainfall in another), could hardly be expected; but a smaller degree of variation might have been hoped for, as the result of accumulated knowledge and experience in the management of jails. Scarcity and the

* This is principally due to the cases of diarrhœa in 1895 having been returned as Catarrhal Inflammation of the Intestines.

prevalence of endemic and epidemic disease among the free population, undoubtedly affect the sickness and mortality in jails, but with the inmates of jails and their surroundings completely under control, it might have been expected that the practical benefits accruing from efficient sanitation and trained supervision would, in some of the instances, have been exemplified in a more striking manner.

The use of prophylactic doses of quinine or cinchonidine combined with iron and sulphuric acid before and during the malarious season of the year should be more extensively tried. In this matter the Punjab has taken the lead, and has already obtained some satisfactory results.

The Andamans had the highest mortality from remittent fever, and the lowest from pneumonia; Assam the highest from ague, diarrhœa and debility; the Punjab the highest from pneumonia, and the lowest from dysentery; Bombay the highest from tubercle of the lungs; the Central Provinces the highest from cholera, small-pox, enteric fever, dysentery, and respiratory diseases other than pneumonia; and Madras the lowest from diarrhœa and from debility.

In each 100 of the total deaths the proportion of fevers was greatest in the Andamans and Assam; of cholera in Burma and Bengal; of pneumonia, in the Punjab; of dysentery, in the Central Provinces; of diarrhœa, in Assam; of tubercle of the lungs, in Burma.

The Principal Officer of the Andamans, says:—"The water supply is not very "satisfactory. In the dry weather before the rains nearly all the wells run dry, and "the tanks become very low. There was a decided scarcity in several places before "the rains this year. Several improvements have been carried out during the year. "Wells have been deepened and tanks cleaned out and protected from contamination. "Several of the large stations are supplied with a patent boiler, and all stations are "supplied with *degchis* for boiling the drinking water. In many places the supervision "of the water is difficult, and the convicts, when at work in the forest, will drink any "water they can get. . . . . The great increase in admissions is due to the "severe prevalence of malarial fevers before and during the early months of the rains. "The daily sick-rate has not been so low for many years, a distinct proof that the "great increase in admissions was due to slight complaints. . . . . Aberdeen "and Phœnix Bay are the only stations which have proved unhealthy during the year. "A large number of convicts have been concentrated in these two places in connection "with the cellular jail and workshops, and malarial fevers and dysentery prevailed "severely among them. A patent boiler has been established in each place, and for "several months now the health has been satisfactory."

The season was of a favourable nature in Burma, the rainfall not excessive, and well distributed over the monsoon months. The drinking water in Upper Burma is not of such good quality as that in the Lower Province, but arrangments are gradually being introduced to sterilise all drinking water by boiling. All the jails in the administration, except five, were overcrowded at one time or other during the year, and in the case of the majority the overcrowding was chronic. Only four out of the past 33 years, namely, 1875, 1880, 1893, and 1895, had death-ratios under 25 per 1,000, and the death-rate of 1895, namely, 17·93, was the lowest of all.

Allowance having been made for the facts that the Native troops in Assam are also unhealthy, and that the tea-garden coolies, free or imprisoned, are, like the troops, imported foreigners, it may be said that the excessive mortality was mainly owing to the absence of proper care in the selection of prisoners employed on extramural labour in the tea-gardens, and to insufficient attention having been paid to the food, water, and clothing of those prisoners while they were so employed. The rules now issued with regard to the working of the system of extramural labour in the four jails where mortality was highest should be productive of the best results. The prisoners on admission into jail are in a low and anæmic state of health, perhaps to a greater extent than in any other province. This calls for a modification of the ordinary prison diet, a diet which may be suitable for men in ordinary conditions of health, but which is not calculated to bring up anæmic and under-fed individuals to the normal standard. The bedding supplied seems also not to afford sufficient protection against the winter cold, and measures are being taken to remedy this.

The year was reported to have been a healthy one in the province of Bengal generally, but the diminished mortality must, in great part, be ascribed to careful supervision, and to the intelligent and effective manner in which local conditions affecting the health of the prisoners have been met and overcome. A beginning was made in the prophylactic issue on a large scale of quinine or cinchonidine. Great

attention was given to the preparation and cooking of the food, and improved cooking ranges were introduced, where necessary. Good nutritious vegetables and anti-scorbutics were freely given, and the supply of milk from jail dairies was encouraged. These, and the measures taken in connection with the supply of drinking water, must be credited with the good general results obtained, and with the absence of all symptoms of scurvy in the central prisons, and their general absence in the others.

Bengal jails which obtain their water from municipal mains do not boil their water, but all the others do, and most of them have been supplied with Larymore's patent boiler for the purpose. Installations of the Pasteur-Chamberlain filter for the Naya Dumka and Motihari jails were ordered at the beginning of 1895, but delay has taken place in their supply from England. The disinfection of wells by permanganate of potassium has been started as a general practice; and for each jail has been purchased the simple apparatus required for the numerical estimate of microbes present in water.

The unhealthiness of the jails at Balasore, Chaibassa, Motihari, Naya Dumka, and Burdwan has been the subject of investigation by special medical committees, and it is hoped that the recommendations, which have met with the approval of Government, made for improving the local conditions, will be successful in reducing the sickness and mortality in those jails.

The Inspector-General of Prisons in the North-Western Provinces and Oudh states that the year 1895 was an exceeding unhealthy one, owing to a succession of bad harvests, and that "the people were consequently emaciated and reduced to a state "of starvation, and suffered a great deal from malaria." A great many of the admissions into the jails were necessarily in a weak state of health, and it is not surprising, he says, "that the sickness and mortality were high." In the year 1895 the mortality among the free population was 29·13 per 1,000, while the average of the previous years was 30·98.

The free population generally, therefore, appears to have been in an average state of health. In some of the districts, however, the medical officers report that a large number of the admissions into jail were in an extremely bad state of health. The greatest mortality occurred among the short-term prisoners, and the mortality among under-trial prisoners was high. Again, the mortality ratio of central jails was only about half that of district jails. All this tends to prove that the opinion expressed by the Inspector-General of Prisons as to the cause of the sickness and mortality is correct, notwithstanding the comparatively low provincial death-rate. The mortality in district jails would no doubt have been higher if efforts had not been made to control it. Medical officers appear to have exercised the powers entrusted to them by modifying the ordinary jail diets as was necessary, and by the issue of extra articles of diet to weakly prisoners.

An outbreak of fever, returned as relapsing, which will be noticed further on, occurred in the Moradabad jail.

The mortality of the Punjab in 1895 was lower than in any of the preceding 19 years, except 1894. If the 20 years period ending with 1895 be divided into four equal periods, it will be found that the mortality has steadily fallen from quinquennium to quinquennium. "These figures," says the Inspector-General of Prisons, "illustrate "how much has been done during the past 15 or 20 years to ameliorate the "condition of the prison population in this province. But the mortality of the jail "population is still higher than it ought to be, owing, no doubt, in some measure, "to the sanitary defects that exist in our jails, which it will take time and con-"siderable outlay of funds to remedy." The increase in the death-rate was due to an epidemic of influenza, which appeared in many of the jails during the month of December. Of the total deaths 38 per cent. were from pneumonia, a disease which has almost invariably been the chief cause of the mortality in the jails of the Punjab; and it seems desirable that extra warm clothing should be issued during the cold season to the prisoners in those jails where this disease is most prevalent, and that hospital accommodation with proper appliances for keeping the air at an equable temperature should be provided for patients admitted with respiratory diseases. The death-rate from dysentery and diarrhœa was the lowest in the record of the last 20 years, and these diseases caused no deaths in 21 out of the 33 jails of the province. The admissions under intermittent fever show a remarkable decrease, which is ascribed by the Inspector-General to "the comparative healthiness of the autumnal "months, and probably in some measure to the administration during the unhealthy "season of fever-prophylactics, large quantities of which were supplied to all jails."

Comparative experiments were made in the Mooltan Central Prison and in the district jails of Delhi and Lahore with regard to the effect on the health of the prisoners of boiled and of unboiled drinking water, but the results were not of a very decisive character. In the jails at Umballa, Ludhiana, Amritsar, and Karnal, where the water has been boiled systematically for some years past, the ratio of admissions into hospital for all diseases was 1,326, 1,295, 2,067, and 1,289, while for all other district jails as a whole the ratio was 1,314. For intermittent fever the ratios were 400, 177, 1,128, 645, and in all other district jails 582; and for bowel complaints the ratios were 276, 91, 268, 149, and in all other district jails 161.

Eight out of the 16 jails in Bombay were overcrowded throughout the year. Looking at the nature of the chief diseases, it is highly probable that the chief cause of the sickness leading to the mortality was in connection with the food issued to the prisoners. The scale of diet in use may theoretically meet the physiological requirements of these prisoners, but they are on a less liberal scale than those in certain other provinces, and to derive from them their full nutritive value it is necessary that the ingredients should be of the best quality, and that the cooking arrangements should be thoroughly efficient and carefully supervised. The Sind jails, as usual, had many cases of pneumonia, so that further improvements seem called for in the matter of clothing, and probably of ventilation. This gang, no doubt composed of selected men, "was "employed on the hardest form of labour in the way of digging and embankment "work"; they were lightly housed, and were exposed to all the variations of temperature and weather; yet they were particularly healthy, owing, no doubt, to the extra liberal diet which they received, and to the sufficiency of bedding and clothing supplied to them.

The high mortality at Akola, in Berar, has not been satisfactorily explained, but was not due to overcrowding, and was probably due to defects of quality or quantity in the food-grains, the vegetables, the antiscorbutics, and in the cooking. The indifferent water-supply in the last quarter of the year doubtless increased the sickness.

The Inspector-General of Prisons in the Central Provinces thus accounts for the increased mortality:—"The unfavourable conditions of the year previous continued "during the past year in an aggravated form. The rainfall was in some places "deficient and in others unseasonable, the seasons were unhealthy, and prices of food-"grains ranged higher than in 1894. The new admissions into jail were generally in "poor health and low condition, many of them being admitted at once into the infirm "gang or into hospital;" and he finds from the reports of the medical officers that "there is a general consensus of opinion that the excessive sickness and mortality of "the past year were induced, not by the circumstances and conditions existing in jails, "but by the consequences resulting from the privations to which the new admissions "had been exposed outside." The scale of diet in force appears to be adequate, provided the cooking be good; but from the experience of previous years, as well as of 1895, there is evidently something wrong with the supply of vegetables and anti-scorbutics. The difficulty of cultivating, under existing circumstances, nutritious varieties of vegetables at all seasons in quantities sufficient to meet the full requirements of prisoners liable to a scorbutic taint is undoubtedly a great one, but it is apparently being overcome in other parts of India.

In the districts of Madras generally the year was not so healthy as 1894; but, although sickness among the prisoners was higher than in 1894, yet the death-rate was, if cholera be excluded, the lowest on record. The Inspector-General of Prisons ascribes the low mortality to the great care given to the proper feeding of the prisoners, and he declares that a high rate of sickness and mortality shows that due care has not been taken in the "proper selection, preparation, and distribution of the food to the "prisoners." "That this is in practice," he continues, "the most important factor in "determining the health of the prisoners in jails in this country I am convinced, and "it is evident that the care devoted to the food can never be relaxed." Again:— "On the whole, the year 1895 was a decidedly wet one, and this fact probably "accounts for a good deal of the increased sickness." The daily issue of prophylactics in the feverish season of the year is to be introduced. As cases of phthisis pulmonalis are on the increase in the central prisons at Coimbatore and Vellore, steps have been taken for the segregation of the patients so affected. The jails at Parvatipuram and Cuddapah have been temporarily closed on account of their unhealthiness.

Progress in reduction of Death-rate.—The following shows a diminution of mortality in the jails of India under all the heads shown, except respiratory diseases, phthisis pulmonalis, and ague :—

Died per 1,000 *of Strength.*

Deaths from	1891–95.	1881–90.
Dysentery	6·56	7·28
Respiratory diseases	5·78	3·72
Diarrhœa	2·26	4·45
Cholera	2·34	2·90
Anæmia and debility	1·89	2·22
Phthisis pulmonalis	2·57	2·41
Ague	·70	·42
Spleen diseases	·20	·23
Hepatitis	·20	·22
Scurvy	·08	·12
Total from all Causes	30·63	34·98

The increase in respiratory diseases and in phthisis is, at least to a great extent, due to the epidemic of influenza, which began in 1890.

Mortality of Prisoners and of Troops compared.—A table is, as usual, here given to compare the mortality of prisoners in 1895 with that of soldiers. Taking the death-rate of European troops as unit, the death-rate of Native troops will be represented by 0·8, and the death-rate of prisoners by 1·8. The mortality of prisoners was comparatively high as regards cholera, bowel complaints, spleen diseases, debility, respiratory diseases, and tubercle of the lungs. Only from fevers was the European soldiers' mortality highest. The enormously greater liability of the prisoners to death from bowel complaints is well shown in the table. Among the prisoners over 34 per cent. of all the deaths were from bowel complaints, and 19 per cent. from respiratory diseases; among the Native troops 7 per cent. from bowel complaints, and 42 per cent. from respiratory diseases; and among the European troops 7 per cent. from bowel complaints, and 4 per cent. from respiratory diseases. While the liability of the Native soldiers to die from respiratory diseases was less than that of the prisoners, yet these diseases made up a larger percentage of the total deaths among the Native soldiers than among the prisoners. Again, fevers accounted for 48 per cent. of all the deaths among the European soldiers, 16 per cent. of all the deaths among the Native soldiers, and 9 per cent. of all the deaths among the prisoners. Taking the mortality of the Native troops from fevers as 1, that of the prisoners is 1·2, and that of the European troops 3·9. Taking the mortality of the Native troops from bowel complaints as 1, that of the European troops is 1·5, and that of the prisoners 12·4. Taking the mortality of the European troops from respiratory diseases as 1, that of the Native troops is 8·5, and that of the prisoners 9·1. The chief cause of death among European troops was fevers, among Native troops respiratory diseases, and among prisoners bowel complaints. Of course, for obvious reasons, too much must not be made of the comparison just instituted :—

Mortality of Prisoners compared with that of Soldiers in 1895.

Causes of Death.	Died per 1,000 of Average Strength.			Relative Liability in Percentages.				Percentages in Deaths from all Causes.		
	European Troops.	Native Troops.	Prisoners.	European Troops.	Native Troops.	Prisoners.	Total 100.	European Troops.	Native Troops.	Prisoners.
Cholera	·45	·41	·80	27	25	48	100	3·0	3·5	2·9
Fevers*	7·31	1·89	2·34	63	16	20	100	47·9	16·3	8·6
Bowel complaints	1·11	·76	9·46	10	7	83	100	7·3	6·6	34·3
Spleen diseases	—	·08	·25	—	24	76	100	—	·7	·9
Anæmia and debility	·01	·35	1·49	1	19	81	100	·1	3·0	5·4
Respiratory diseases	·57	4·87	5·17	5	46	49	100	3·7	42·0	18·7
Tubercle of the lungs†	·52	·67	2·51	14	18	68	100	3·4	5·8	9·1
All other causes	5·29	2·57	5·59	39	9	42	100	34·6	22·1	20·1
All Causes	15·26	11·60	27·61	28	21	51	100	100·0	100·0	100·0

* Enteric, intermittent, remittent, and simple continued fevers. † Includes acute and chronic pneumonic phthisis.

General Population.

General remarks.

As has been pointed out in former reports, the statistics with which this chapter deals are in many cases very far from being accurate, but they are useful for purposes of comparison. In rural areas, where the collecting agency is generally illiterate, and underpaid, defects are to be expected, but in municipalities, where the registration of births and deaths is legally compulsory, better results might be hoped for. Registration in the municipal towns is, however, generally much less accurate than in the rural areas. The municipal authorities themselves are apparently not alive to the importance of correct statistics, and unless the Local Governments and administrations will bring pressure to bear upon the committees, it is to be feared that no improvement will be effected. Until vital statistics are completely and accurately registered, it must be impossible to measure accurately the effect of any efforts made to improve hygienic conditions.

The proposals for placing the executive of the Sanitary Department in a more satisfactory position, to which allusion was made in this report for last year, are still being considered by the Government of India in communication with Local Governments. The great difficulty is the lack of funds, but it seems that it will be very difficult to secure a uniform system for the whole country. It can be readily understood that, although an agency may be very suitable for Lower Bengal, an exactly similar agency would be useless and perhaps harmful in, say, the Punjab.

As in 1894, the highest birth-rate was recorded in the Punjab, and the lowest in Coorg. In Madras, Bombay, Bengal, Berar, and Lower Burma, the ratios were higher than in the previous year. In all provinces, it will be seen that the extreme birth-rates, both in urban and rural circles, vary very widely. In seven provinces the birth-rate was in excess of the death-rate, the excess ranging from 3·20 per 1,000 of the population in Bengal, to 14·6 in the Punjab. In the remaining five provinces the numbers of deaths were greater than the numbers of the births in millesimal ratios varying between 12·7 in Berar, and 2·92 in Coorg.

Throughout the country, except in the small provinces of Assam, Berar, and Coorg, the death-rates were lower in 1895 than in the previous year. The highest death-rate was recorded in Berar and the lowest in Coorg. As in the case of births, the differences between the highest and lowest death-rates recorded were very great in both urban and rural circles in every province.

In the following table, the deaths recorded from all causes in the different provinces are shown month by month :—

Statement showing the Deaths from all Causes according to Months in the different Provinces of India during the year 1895.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratios of Deaths per 1,000 of Population.	
														1895.	1894.
Bengal - - -	196,719	145,508	154,095	220,402	164,592	139,727	156,928	156,854	171,276	192,522	224,158	308,677	2,231,458	31·39	34·88
Assam - - -	12,636	9,520	10,339	13,509	16,422	15,500	12,497	12,449	12,895	15,328	18,350	19,859	169,304	33·72	30·69
North-Western Provinces and Oudh.	128,004	86,992	80,437	99,245	111,533	93,232	88,672	105,080	116,723	145,143	153,679	157,098	1,366,443	29·13	42·51
Punjab - - -	54,958	42,182	41,376	42,773	53,393	46,245	42,278	42,947	47,896	55,493	58,441	73,990	601,972	29·29	36·52
Central Provinces - -	21,753	20,551	23,182	24,238	27,475	24,603	25,175	36,665	40,580	40,362	32,848	31,703	319,137	33·75	37·22
Berar - - -	7,685	7,697	9,219	10,602	11,409	9,928	14,749	19,722	17,216	13,760	10,023	9,927	141,037	49·9	42·0
Lower Burma - -	8,033	6,763	6,354	7,451	7,516	8,783	11,124	10,782	8,545	8,307	8,886	8,612	101,160	22·40	23·56
Madras Presidency -	58,963	47,849	49,906	44,654	52,000	51,233	58,032	60,011	59,081	56,713	56,719	63,553	658,719	19·6	20·0
Bombay Presidency -	42,174	37,206	40,460	41,403	41,879	40,959	47,541	54,628	49,433	46,912	45,886	50,043	538,540	28·61	32·26
Ajmere-Merwara - -	1,200	1,159	1,429	1,337	1,495	951	905	1,001	1,136	954	1,363	1,670	14,614	26·95	31·02
Coorg - - -	289	309	317	386	461	660	629	479	439	330	380	325	5,073	29·31	24·59
Mysore - - -	4,942	4,620	6,048	6,560	6,419	5,642	5,958	5,535	4,964	4,788	5,060	5,786	66,322	13·69	12·36
Total - -	537,365	410,356	423,166	512,563	494,599	437,489	484,488	506,753	530,187	580,672	615,798	731,243	6,244,678	—	—

The population of Bengal, excluding the Chittagong Hill Tracts and the new district of Angul, in which vital statistics are not yet registered, was found to be 71,070,233 at the last census in February 1891. This figure is used for the calculation of ratios. In the towns registration is compulsory. In the rural areas, since 1892, the statistics

have been collected by the village watchmen and recorded by them at the police stations and out-posts, which are the registering centres. Although improvement in registration has been brought about, much remains to be done, and means are being considered to render the existing arrangements more efficient. The provincial Sanitary Commissioner points out, however, that, until the people themselves begin to take some interest in registration and lend their aid voluntarily to the registrars, and until the compulsory clauses of the Registration Act are more rigorously enforced in the towns, there is not much hope of obtaining accurate results. In 1895, there were 2,049 persons convicted of neglecting to register, against 1,923 in the previous year, and from them a sum of Rs. 3,153-14 was realised as fines, or Rs. 495-15 more than in 1894; 427 persons were merely warned.

The total number of births registered was 2,548,623, or 34·59 per 1,000 of the population, as compared with 32·81 in 1894 and 35·66 in 1893. Among the districts, the highest rates were recorded in Noakhali (46·61), Backergunge (45·92), and Hazaribagh (42·71); and the lowest in Hooghly (27·24), the Twenty-four Parganas (25·73), and Calcutta (16·05). The average birth-rate in the towns was 23·92 per 1,000, against 22·77 and 26·27 in 1894 and 1893 respectively. In no town is the calculated provincial average birth-rate of 51·8 per 1,000 approached; the highest rates obtained were 44·17 in Jamalpore, 42·75 in Chatra, 42·27 in Jamui, and 41·60 in Roserah. In 13 towns, the rates were between 40 and 35; in 29, between 25 and 30; in 34, between 30 and 25; in 31, between 25 and 20; and in 36, below 20. With one or two possible exceptions, defective registration is common to all the towns, so that the birth-rates are greatly understated. The ratios are also lowered by the custom of many women who live in towns, returning to their family homes in the rural areas to be confined. In some towns there is a preponderating male population; this is the case in Jhalakati in Backergunge, from which, as usual, the lowest birth-rate was returned, 5·49 per 1,000. In the rural areas the average birth-rate was 35·13 per 1,000, against 33·32 in 1894, and 36·14 in 1893. In 42 rural areas, rates above 45 per 1,000 were obtained, including three over 60, namely, Phulbaria (65·00), and Kalihati (62·98) in Mymensingh, and Kushtia (62·51) in Nadia. In the province, generally, there were 106 males born for every 100 females.

The total number of deaths registered was 2,231,458, and the death-rate was 31·39 per 1,000, as compared with 34·88 and 28·21 in 1894 and 1893 respectively. Among districts, the highest rates were recorded in Jessore (41·48), Calcutta (39·66), Nadia (38·80), and Hooghly (38·67); the lowest in Noakhali (25·27), Lohardaga (24·82), the Sonthal Parganas (23·22), and Singhbhum (19·62). In the towns, the average recorded mortality decreased from 35·34 in 1894, to 34·40 per 1,000 in 1895, ranging from 59·44 in Bhadreswar in Hooghly, to 15·41 in Chapra, and 12·68 in Jhalakati. In the rural areas the average death-rate fell from 34·85 in 1894 to 31·24 in 1895, the figures ranging from 41·52 in Jessore to 19·46 in Singhbhum. In the province, generally, the average death-rate among males was 33·76 per 1,000, as compared with 29·04 among females; the corresponding figures for 1894 were 37·16 and 32·61. The death-rates, per 1,000 living of infants under one year of age, were, for males 216·59, and for females 175·53, as compared with 234·38 and 191·23, in 1894. At all age periods the male death-rates were the higher, the difference being least between the ages of 15 and 20. Among the various classes the highest death-rate was registered for Muhammadans, 32·96 per 1,000; the death-rate among Hindus was 31·05; among Christians it was 18·31, among Buddhists 22·74, and among "other classes" 23·69.

The number of European seamen who arrived in the Port of Calcutta in 1895 was 18,015, against 17,900 in the previous year, but the average number present daily in the Port was less, 1,413 as compared with 1,481. The number of deaths was 40 against 27, and the death-rate per 1,000 19·56 against 18·23 in 1894. The average native population afloat is estimated to have been 25,630, and the number of deaths among them was 123, or 4·79 per 1,000 against 5·34 in the previous year.

The population of that portion of the province of Assam, where the registration of vital statistics was fully carried out in 1895, was, according to the census of 1891, 5,021,084, and the population of the area, where registration was compulsory, was 105,431. As in the previous year, statistics were collected in certain villages of the Garo Hills and in Kohima, which are not included in the general figures. In the selected Garo villages, the average birth-rate was 36·75 per 1,000 of the population, against 25·82 in 1894, and the death-rate 29·79 against 30·01. In Kohima, where the population consists of 1,247 males and 534 females, the birth-rate was 20·21 per 1,000, about 9 per 1,000 less than in 1894, and the millesimal death-rate 19·09, against 16·84 in the preceding year.

The number of births registered in the different districts of the province was 155,631, and the birth-rate was 31 per 1,003, against 31·10 in the previous year. In Cachar and Sylhet the birth-rates were 31·09 and 34·05 respectively, giving an average birth-rate in the Surma Valley of 33·62 per 1,000, which is much higher than the average of the Brahmaputra Valley, 28·40, or than the rate obtained in the selected areas of the Khasi and Jaintia Hills, 25·79. In the districts of the Surma Valley and in Goalpara, where the highest birth-rate, 42·29 per 1,000, was recorded, the collecting agency is paid; in the other districts the *gaonburas* who furnish the statistics being unpaid cannot be punished for remissness. The lowest rate of all, 22·07 per 1,000, was returned from the Nowgong district; there has been much sickness in this district for some years, but the very low birth-rate is mainly due to defective registration. About 30 per cent. of births in the province, as a whole, escape record. The average birth-rate in the nine head-quarter towns, where registration is legally compulsory, fell from 24·28 per 1,000 in 1894 to 20·80 in 1895, ranging from 29·26 in Dibrugarh to 16·96 in Sylhet. While it is a fact that there is a great excess of males in these towns, the birth-rates are very much understated. In 1891 the number of females in the head-quarter towns was 25,171, the number of births in 1895 was 1,413; calculating the ratio on double the number of females, 50,342, the birth-rate is only 28·07 per 1,000; now the calculated birth-rate for Assam is 48, so that in the head-quarter towns little more than half the actual numbers of births are registered. The average birth-rate in the 11 sub-divisional towns rose from 29·97 in 1894 to 31·24 in 1895; extreme rates of 53·86 and 8·58 per 1,000 were recorded in North Lakhimpur and Mangaldai, respectively; in the other sub-divisional towns the rates varied between 37·60 in Barpeta and 21·68 in Maulvi Bazar. In these towns the male population is to the female in about the proportion of 3 to 2. Estimating the birth-rate on double the female population, it is about 38 per 1,000.

The number of male births registered was 108 to every 100 female births; in the Surma Valley the percentage was 106, while in the Brahmaputra Valley it was 109.

The number of deaths registered was 169,304, or 13,673 more than the births. The death-rate was 33·72 per 1,000, as compared with 30·69 in 1894. The death-rates in Cachar and Sylhet were 32·01 and 32·41 per 1,000 respectively, giving an average for the Surma Valley of 32·37 in 1895, as compared with 27·62 in the previous year. In the Brahmaputra Valley, the average rate was 35·33, highest in the districts of Goalpara (42·72) and Nowgong (42·28). As registration in the latter is very defective, the actual mortality in that district was probably the highest in the province. The lowest death-rate in the Brahmaputra Valley was 28·82, recorded in Sibsagar, but this is much higher than the 22·76 per 1,000 registered in the Khasi and Jaintia Hills. In the head-quarter towns, the average death-rate increased from 25·55 per 1,000 in 1894, to 28·87 in 1895. If the deaths which occurred in the dispensaries are included, the average rate was 41·60, against 37·02 in 1894. Excluding these deaths, the highest rates were 52·61 and 48·70 per 1,000 recorded in Tezpur and Dibrugarh, respectively, and the lowest 17·91 and 12·95 in Sibsagar and Shillong. In the sub-divisional towns the average death-rate was 48·23 per 1,000, including deaths in the dispensaries, and 43·47 if these are excluded. Neglecting such deaths, the highest rates were 70·08 per 1,000 in Barpeta and 45·78 in Mangaldai, and the lowest, 23·96 in Maulvi Bazar, and 18·46 in Hailakandi. On an average, there were recorded the deaths of 113 males for every 100 females. In Nowgong 150 male deaths were registered for every 100 of females.

In the Surma Valley, and in the province as a whole, the highest mortality occurred in December and November, and the lowest in February. In the Brahmaputra Valley, the largest number of deaths was registered in May and the next largest number in June.

Calculated on the number of children under one year of age when the census was taken in 1891, the ratio of deaths per 1,000 of infants was 191·29 among males, and 176·60 among females. Between the ages of one year and five years, the millesimal death-rates were 39·01 among boys, and 37·79 among girls. Excepting persons between the ages of 15 and 30, the death-rates of males were higher than those of females. The death-rate among Hindus, 30·81 per 1,000, was followed by rates of 33·13, 35·43, and 55·14, among Muhammadans, Christians and "other classes" respectively.

The total number of births recorded in the North-Western Provinces and Qudh in 1895 was 1,637,235, as compared with 1,862,035 in the previous year. Although the year was exceptionally healthy, and the births exceeded the deaths by no less than

5·77 per 1,000, it will be noticed that the birth-rate, 34·90, was considerably lower than the rate recorded in 1894, which was 39·70, and lower than the quinquennial average, 37·47. The prevalence of severe sickness, particularly malarial fevers, in the previous year, probably accounts for the falling off in the birth-rate. Among the districts, the highest rates were recorded in Bulandshahr, 55·43 per 1,000, followed by Aligarh 52·36, Etah 51·29, and Agra 51·04. In the districts of Partabgarh, Benares, Naini Tal, Fyzabad, Jaunpur, Ballia, Ghazipur, and Azamgarh, the rates were below 26·0 per 1,000. In 24 of the 48 districts, the rates were higher than the average. In rural areas, the average birth-rate was 34·29 against 39·80 in the towns; in the former, the rate was nearly 4 per 1,000 below the quinquennial mean, in the latter, it was more than 7·0 per 1,000 above it. Among the towns there were great deviations from the average, the extremes, excluding hill stations and Brindaban, where the circumstances are peculiar, having been 64·27 in Fatehpur-Sikri, and 24·83 in Saharanpur. The percentage of male to female births in the province generally was 109·62, slightly higher than in 1894, when the percentage was 109·58, and this again was higher than the figure of the previous year, 109·47.

The number of deaths recorded was 1,366,443, or 627,335 less than in 1894. The death-rate was 29·13 per 1,000, against 42·51 in that year, and 33·34, the average of the previous five years. Among the districts, the highest rates were registered in Kheri (44·54), Naini Tal, which includes the Tarai (43·57), followed by Hamirpur (40·89), and Saharanpur (40·79); the lowest rates were registered in Partabgarh (21·97), Allahabad (21·78), Mainpuri (21·02), and Ballia (20·71). The average death-rate in rural areas was 28·58 per 1,000 against 33·46 in the towns, the rates among the latter, excluding hill stations, varying between 75·64 per 1,000 in Deoband, and 17·28 in Bareilly. With the exceptions of Fyzabad (51·22) and Benares (45·30), in none of the larger towns were high death-rates recorded, but among the smaller towns high rates were registered in Deoband (75·64), Baghpat (59·92), and Kashipur (48·17). In 23 municipalities the deaths were more numerous than the births. In some of these the prevalence of malaria and other circumstances partially explain this, but in the majority registration is at fault. As the provisions of the Vaccination Act are enforced in the municipalities, and the vaccinators are furnished with copies of the birth registers, it may be that parents not wishing to have their children vaccinated do not register their births. Among the various classes the Hindus had the highest death-rate, 29·22 per 1,000, then the Muhammadans, 28·68, and then "other classes," 24·79. Among infants under one year the ratios of mortality per 1,000 living were 217·87 for males and 208·32 for females; among boys and girls between one year of age and five, the ratios were 47·88 and 46·68 respectively. In the age-periods from 15 to 30 the death-rates of females were higher, at all other periods they were lower, than the death-rates of males. In January the number of deaths was greater than the average of that month, but the death-rate fell in February, and although showing the customary rise in April and May, remained below the mean throughout the year, reaching the maximum in December. The cause of the unusual rise in November and December is believed by the Provincial Sanitary Commissioner to be the abnormally high temperature in the former month.

The percentages of omissions detected in registers examined by civil, revenue, and police officers, were as regards births 2·78, and as regards deaths 2·64. There were 241,988 cases tested by the vaccination staff, the detected omitted percentages were of births 1·46, and of deaths ·72. In only 25 out of 103 municipalities were fines imposed for neglecting to register. The total number of persons fined was 1,068, and the amount realised Rs. 267-15-6.

In recent reports details have been given of the special efforts being made in the Punjab to improve the registration of vital statistics. The measures taken have, of course, been mainly towards the detection, by means of existing machinery, of omissions in the registers. Village registers are examined by the Sanitary Commissioner and by his deputy, by District Officers, Civil Surgeons, Tahsildars and Naib Tahsildars, and by the members of the Vaccination Staff. In 1894 five Divisional Inspectors of Vaccination and Registers were specially appointed. During 1895 considerable numbers of omissions were detected by the Sanitary Commissioner, by his deputy, and by the Civil Surgeons of Umballa and Gujranwala. The Tahsildars and Naib Tahsildars discovered 4,029 omissions, as compared with 1,555 in 1894; this is an improvement, but in many districts the inspections made by these officials seem, so far, to be of little use. The vaccinators inspected the registers in 15,839 villages, and detected the omissions of 13,042 births and of 3,652 deaths, as compared with 305 and

78, respectively, in 1894. The five special Divisional Inspectors discovered in the registers of 2,988 villages, the omissions of 10,835 births and 6,269 deaths. For every 100 villages inspected the Tahsildars discovered 30 omissions in the registers, the Vaccinators 105, and the special Inspectors 572. All these omissions were brought to the notice of the District Officers concerned, and were duly entered in the registers. The laws regarding the compulsory registration of births and deaths are available in 151 municipal towns, but they do not seem to be generally enforced. During 1895, 117 persons were fined for failing to report. The aggregate of the fines was Rs. 99, against Rs. 164 realized in the previous year.

In 1894 the birth-rate in the Punjab was 43·93, the highest ever recorded. In 1895 the rate was almost as high, a total of 901,584 births yielding a rate of 43·86 per 1,000 of the population according to the census of 1891. The highest district birth-rates were recorded in Gujranwala (54·4), Jhang (51·9), Gurgaon (51·7), Rohtak (50·9), and Ferozepur (50·7). Excluding the hill districts of Simla and Kangra and the frontier districts, the birth-rates in the remainder, with five exceptions, varied between 50 and 45 per 1,000. The exceptions were the districts of Amritsar (42·7), Gurdaspur (39·7), Jullundur (39·1), Umballa (38·7) and Hoshiarpur (37·2); the Provincial Sanitary Commissioner attributes these low rates to the unhealthiness of these districts in 1894. In the frontier districts since 1894 there has been a steady improvement in the registration of births, particularly in Kohat, Bannu, and Dera Ismail Khan; for instance, the average birth-rate in Kohat for the five years ending 1893 was 25·9 per 1,000, in 1894 it had increased to 40·4, and in 1895 to 42·0.

The average birth-rate in the rural circles was 44·3 per 1,000, as compared with 40·0 in the towns. Among the latter, the highest rates were recorded in Chiniot, Palwal, Chunian, Sialkot, Kaithal, Panipat, and Maghiana, all over 50 per 1,000; the lowest in Tanda, Urmar, Kartarpur, and Kohat, 30 per 1,000, and Sadhaura 27.

The percentage of male as compared with female infants born was 110·6, or 1·2 per cent. less than in 1894. In Peshawar the percentage was 141·4, compared with 153·9 in the previous year, and in Dera Ghazi Khan 128·9, compared with 127·1. With regard to Peshawar, the Deputy Commissioner is of opinion that the apparent preponderance of male births is mainly due to carelessness in the reporting of births generally.

The total number of deaths registered was 601,972, equivalent to a death-rate of 29·29 per 1,000 of the population, as compared with 37 in 1894, and 37·3, the mean of the previous five years. In only two districts, Simla and Umballa, were the numbers of deaths registered in excess of the births. The highest death-rates were recorded in Umballa (42·55), Karnal (37·17), and Delhi (36·96); the lowest in Shahpur (20·26). In rural circles the average death-rate was 28·8 per 1,000, as compared with 33·7 in the towns. Among the larger towns, the highest death-rate was recorded in Jagadhri, 50·12 per 1,000; after Jagadhri came Delhi, Soneput, Karnal, Umballa, Amritsar, Kaithal, Panipat, and Rawal Pindi, with rates between 43 and 39. The lowest rates were 26·39, 26·26, and 21·06, recorded, respectively, in Jalalpur, Gujrat, and Bhera.

The death-rate of the Hindu population was 30·41, as compared with 28·40 among Muhammadans, and 14·37 among Native Christians. The death-rates among infants under one year of age were for males 218·05, and for females 210·14 per 1,000 living. In certain districts, namely, Jullundur, Ludhiana, Ferozepore, and Amritsar, the deaths of female infants greatly out-numbered the deaths of males. Among children over one year of age and under five, the death-rates were, for boys 40·63, and for girls 43·14 per 1,000. Except in infancy, and during the age-periods over 40, the female death-rates were the higher. In the province generally 112·2 deaths of males were reported for every 100 deaths of females.

The highest mortality occurred in November and December, and the lowest in February and March. In the four hill sanitaria, Simla, Dharmsala, Dalhousie, and Murree, the average birth and death rates were respectively 23 and 32 per 1,000; and in the 30 cantonments the average birth-rate was 9 and the average death-rate 12 per 1,000.

In the Central Provinces vital statistics are collected by the village *Kotwars*, most of whom are illiterate villagers, badly paid for their work. From the *Kotwars'* books the entries are copied into the police registers, both sets of entries being compared by the native Superintendents of Vaccination. Errors in the police registers can result only from incorrect copying, but the Superintendent of Vaccination is supposed to make a house-to-house enquiry to discover births that may have been omitted by the

Kotwars. The native Superintendents inspected 2,801 villages, and detected a large number of discrepancies, but less, perhaps, than might have been expected, considering the collecting agency; indeed, the provincial Sanitary Commissioner thinks that the *Kotwars* do wonderfully well, allowing for the disadvantages under which they labour. In the municipal towns registration is compulsory, the compilation this year, for the first time, having been carried out by the Civil Surgeons. During the year 379 persons were fined an aggregate sum of Rs. 394-6-6 for omitting to report births and deaths, and 338 others were warned for the same offence.

In 1895 the number of births recorded was 317,432, or 51,452 less than in the previous year. The birth-rate, which was the lowest registered for 15 years, was 33·41 per 1,000 as compared with 38·82 in 1894, and 39·39, the quinquennial mean. In all of the districts, except four, Nimar, Burhanpur, Betul and Chhindwara, there was a decrease in the birth-rate as compared with 1894. The falling off in the birth-rate is attributed to the excessive sickness prevalent in 1894, to the scarcity and privation from which the people in many of the districts have suffered for some years past, which has limited the number of marriages, and has led to emigration of many unable to obtain employment and food at home. All these causes have contributed to lessen the actual number of births, but, in addition, the anxiety suffered by those in straits for food have made them careless in reporting births.

Among the districts, in only three, Nimar, Betul and Chhindwara, were rates over 40 per 1,000 registered, the lowest rates were 24·09 in Damoh, and 20·69 in Saugor. In 14 of the districts, against 11 in 1894, the birth-rates were lower than the death-rates. But, while in 1894 the excess of births over deaths in the province as a whole was 1·60 per 1,000 in 1895, the excess of deaths over births was 3·34 per1,000.

The average rural birth-rate was 33·63 per 1,000 against 30·33 in the 47 towns, in 35 of which the deaths exceeded the births in number. The highest birth-rates were 70·76 per 1,000 recorded in Multai, a town of 3,505 inhabitants in the Betul district, 50·85 in Mohgaon, and 46·86 in Wardha; in five other towns rates over 40 per 1,000 were registered. The lowest rates were 14·0 and 18·97, recorded respectively in Sambulpur and Hatta, and from 19 other towns, including Seoni (22·04), Jubbulpore (22·62), Saugor (23·37) and Raipur (26·18), rates under 30 per 1,000 were returned. The percentage of male to female births in the whole province was 105·61.

The total number of deaths recorded was 349,137, equal to a death-rate of 36·75 per 1,000. This is nearly 4 per 1,000 in excess of the quinquennial mean, and only ·47 per 1,000 less than the high death-rate of 1894. In that year the mortality was mainly due to a severe epidemic of influenza and to fevers; in 1895 influenza appeared in a mild form in three districts only, and the fatal cases of fever diminished by 17,133. On the other hand, in 1895 there were 8,463 more deaths due to cholera, and 5,144 more due to small-pox than in the previous year. The death-rates in the districts ranged from 57·06 in Nimar, 53·45 in Narsinghpur, and 51·86 in Saugor to 26·45 in Bilaspur, 25·70 in Raipur, and 22·73 in Sambalpur. The average death-rate in rural circles was 36·55 as compared with 40·07 in the towns. In 14 towns death-rates over 50 per 1,000 were registered, including the following very high rates, 78·38 per 1,000 in Badnur, 73·89 in Multai (both in Betul), 64·22 in Deori, and 61·88 in Rehli (both in Saugor). The lowest rates were 23·92 recorded in Mandla, 22·30 in Dhamteri, and 20·11 in Sambalpur. The heaviest mortality occurred in the months of August, September and October, the lowest in February.

Among infants under one year of age the death-rate per 1,000 living for males was 384·30, and for females 342·15; among boys and girls between one year and five years of age, the death-rates were, respectively, 51·63 and 43·67. At all age-periods the male death-rates were the higher. The millesimal death-rate among Muhammadans was 39·89, among Hindus it was 33·54, and among "other classes" 53·93.

In Berar, as described in the report for last year, the village officials collect and register vital statistics, and the police compile and classify them. The village records are tested by the Superintendents of Vaccination. Whilst inspecting the results of vaccination in a village they examine the registers. If the number of entries is suspiciously low a house-to-house visitation is made, until the names of a considerable number of infants are obtained, the names of infants who have died subsequent to vaccination being also noted. The list of names are then compared with the registers, and omissions are reported. Omissions of births are more frequent than omissions of deaths. During the year 1,793 village registers were thus examined against 2,293 in 1894, and 6 per cent. were found to be defective. Besides these inspections many officers, including Deputy Commissioners, Civil Surgeons, officers of the Police and *Tahsildars* examined, in all, 6,200 registers, of which 6 per cent. were found defective.

The total number of births recorded was 105,952, or 11,193 more than in 1894, and the birth-rate was 37·2 per 1,000, compared with 33·3 in the previous year, and 38·9, the mean of the previous five years. Except in Basim, where there was a decrease of ·1 per 1,000, in all the districts the birth-rates were higher than in 1894, the excess ranging between 6·4 per 1,000 in Buldana, where the birth-rate in 1895 was 44·2 and 1·1 in Wun, where the rate was 25·4. These were the two extreme district rates. The provincial Sanitary Commissioner does not believe that the low and decreasing rates recorded in Wun and Basim are altogether due to the backwardness of registration in these districts, but partly to a real falling off in the number of births from bad harvests and deficient food, which have led, in many instances, to reduction in the number of the villagers. The average birth-rate in the rural circles was 36·9 as compared with 40·1, the average in the towns. The urban rates were the higher in all districts, except in Ellichpur and Akola, where they are apparently reduced by the comparatively low rates registered in the towns of Ellichpur, Akola, Khamgaon, Jalgaon and Hiwarkhed, where the rates are below the average rate of the other town circles in the districts. The percentage of males to females born was 105·2, ranging from 106·9 in Buldana to 104·1 in Ellichpur. The greatest numbers of births were registered in the months of March, October, August and September, the least in January, June and May.

The number of deaths recorded in 1895 was 141,937, or 22,376 more than in the previous year. The increase was mainly due to cholera, dysentery and diarrhœa, which, together, accounted for an increase of 18,033 deaths. The death-rate, which has been exceeded only twice, in 1878 (81·5) and 1883 (51·3) during the last 28 years, was 49·9 per 1,000 of the population as compared with 42·0 in 1894, and 35·4 the quinquennial mean. The highest death-rates, 58·4 and 55·3 per 1,000 were recorded in Basim and Buldana, where the incidence of cholera was most severe. The lowest district death-rate was 41·6, registered in Wun. In only one of the 67 rural circles was the registered mortality below 30 per 1,000, in eight it was between 30 and 40, in 25 between 40 and 50, in 20 between 50 and 60; while in 13 it was between 60 and 73·1. In each of these 13 circles the excessive death-rates were due to cholera. The average death-rate in rural circles, which was 50·4, exceeded the average rate in the towns by 4·0 per 1,000. Only in Wun, where the two towns suffered much from cholera, was the urban death-rate higher than the rural. The highest death-rates in the towns were 76·0, 69·2 and 68·4 per 1,000 recorded respectively, in Digras, Pusad and Deulgaon Raja, but in 11 others the rates were between 53 and 60 per 1,000. The excess of mortality in these towns was due to cholera, or to both cholera and fevers. The lowest rates were 35·5 registered in Akola, and 32·9 in Mangrul Dastgir.

In every district the male death-rate was higher than the female, the provincial average having been 111·6 deaths among males for every 100 among females, while in the districts the percentages ranged from 121·1 in Wun to 106·7 in Buldana. In the towns there were greater differences, *e.g.*, 186 in Yeotmal, 143·8 in Pusad, and 136·5 in Amraoti, compared with 97·7 in Talegaon, 95·5 in Anjangaón, and 93·1 in Wadegaon. In the last three towns more female children were born than males, which, Dr. Little considers, may, in a measure, account for the higher female death-rate. The mortality in the third quarter of the year (18·2 per cent. of the total) was more than twice as great as the mortality in the first (8·6), the mortality in the second (11·2), and fourth (11·9), being about equal to each other. The largest number of deaths (19,722) was registered in August, and the smallest number (7,685) in January.

Among infants the death-rates per 1,000 living were, among males 310·5, and among females 276·4. Boys between one and five years of age died at the rate of 122·8 per 1,000, and girls at the rate of 109·3. From five years to ten years the male rates continued higher, but not until the age-periods above 40 were they again higher than the female rates.

The mortality among the 492 Native Christians in the province was at the rate of 73·1 per 1,000; among "other classes" the death-rate was 56·5, among Hindus it was 50·1, and among Muhammadans 43·9.

The total number of the population of Madras Presidency, among whom vital statistics were recorded in 1895 was 33,605,784, according to the census population, or about two and a half millions less than the estimated population. In some hill districts, zemindaries and certain islands on the west coast, inhabited by a population of 2,036,044, registration is not yet carried out.

The total number of births registered was 976,572, equal to a birth-rate of 29·1 per 1,000 of the census population as compared with 27·7 in 1894, and 26·7, the mean of the previous five years. The highest birth-rate recorded among the districts was 38·4 in Chingleput; the lowest 17·3 in Ganjam. The average birth-rate of the rural circles was 28·7 per 1,000 as compared with 33·6, the average of the town cirles. The highest rates obtained in town circles were 53·0 per 1,000 at Vaniyambadi in Salem, 48·8 in Kayalpatnam, and 46·2 in Sivakasi, both in the Tinnevelly district; the lowest rate was 7·1 recorded in Samalkot, in Godaveri. In Madras town the rate was 42·5. The provincial Sanitary Commissioner states that a good deal of improvement in the accuracy of registration in municipalities has been effected by a procedure devised for the better checking of the results of compulsory vaccination. Under this system each infant born is identified with a number, and by means of special registers its history is followed until it has been vaccinated. It has been discovered that the municipal subordinates, in order to obtain or manitain a reputation for the discovery of unrecorded births, recorded births that never took place. Dr. King does not think this practice is widespread, as it can only exist in places where pressure to obtain favourable results is put on unscrupulous subordinates, without sufficient care being taken to check their reports. The percentage of male to female births was 104·3, ranging from 108·9 in Ganjam to 108·8 in Kurnool.

The total number of deaths recorded was 658,719, and the death-rate was 19·6 per 1,000 as compared with 20·0 in 1894, and 20·6, the mean ratio of the previous five years. Among the districts the rates ranged from 25 per 1,000 in Tinnevelly to 13·6 in Ganjam. The average rate obtained in rural areas was 19 per 1,000 as compared with 27·2 in the towns. Among the latter the highest rates were recorded in Kayalpatnam (42·9), Madras (38), Sivakasi (37), and Tenkasi (36·3). In 13 towns rates under 12 per 1,000 were recorded, including Shendamangalam (9·1), Tiruvannamalai (8·4), Pithapuram (7·7), Ambur (6·1), and Sainalkot (5·7). The greatest mortality occurred in December, the least in April. For every 100 female deaths recorded there were 104·8 male deaths.

Among infants under one year of age the death-rates per 1,000 living were, males 150·2 and females 123·3. Among boys and girls between one year and five years of age the death-rates were, respectively, 24·2 and 22·2 per 1,000. In the age-period 10 to 14 the female death-rate was slightly higher than the male, and between the ages of 15 and 29 the female rates were considerably the higher. At all other periods the male rates were the higher.

Among the various classes the highest death-rate, 19·9 per 1,000, was registered among Hindus, and the lowest, 9·5 among the comparatively very small population of "other classes," while Muhammadans, 17·2, and Native Christians, 15·6, occupied intermediate positions.

The population of Coorg consisted at the time of the census of 1891 of 95,907 males and 77,148 females. In 1895 the number of births recorded was 4,567, equal to a birth-rate of 26·39 per 1,000 as compared with 26·43 in the previous year, and 19·89 the quinquennial mean. In rural circles the average rate was 27·48 as compared with 15·28 in the towns. The number of males born for every 100 females born was 99·69, but in the towns, which are very small, there were great differences in the proportions of the sexes born.

The total number of deaths registered was 5,073, an average of 29·31 per 1,000, as compared with 24·59 in 1894, and 25·61, the average of the previous five years. The average death-rate in rural circles was 28·77, as compared with 34·88 in the towns. June was, as usual, the month in which the greatest number of deaths was recorded; the smallest number was registered in January. Among infants under one year of age, the death-rates per 1,000 living were 287·88 for males, and 253·06 for females. Boys between one year and five years died at the rate of 35·22 per 1,000, and girls at the same ages died at the rate of 30·82. In the age-periods between five and 30, the female death-rates were the higher. The lowest death-rate was registered among the Muhammadans, 25·74 per 1,000, the Hindus following with 29·47, and "other classes" with 35·24.

In the Bombay Presidency, the village registers are examined by the Vaccinators, whose duty it is to report any discrepancies they may discover to the Deputy Sanitary Commissioner of the registration district. This system is reported to render results more accurate, but it is feared that it may damage the cause of vaccination If a Vaccinator is too zealous in his scrutiny of the registers, he embroils himself with the

village headman, and it is on the goodwill of the latter that much of the success in obtaining children to be vaccinated depends.

In the Presidency, including Sind, there were 674,304 births registered, or 14,036 in excess of the number recorded in 1894. The birth-rate was 35·83 per 1,000 of the population, against 35·08 in the previous year, and 36·04, the mean of the previous five years. In the Western, Central, Southern, and Gujarat Registration Districts the birth-rates were higher than in 1894; in Sind (24·98), where registration is particularly defective, there was a decrease of nearly 2 per 1,000. In only two collectorates were the ratios over 45 per 1,000—Ahmednagar 47·66 and Khandesh 45·65. In six others the rates were over 40·0. The lowest rate in any collectorate, except 19·07, registered in the city of Bombay, was 19·32 per 1,000, registered in Hyderabad. The average recorded birth-rate in rural circles was 36·78 against 29·04 in the towns. Among the latter, the rates ranged from 57·99 in Athni to 17·53 in Nasik. In four other towns, Borsad, Sangamner, Ahmednagar, and Vengurla, the rates were over 55 per 1,000, in four others besides Nasik, namely Bombay, Jacobabad, Mahad, and Thana, the rates were below 20. In the Presidency generally the percentage of male to female births was 108, but in the Sind district the percentages varied from 117·41 in Karachi to 131·86 in Hyderabad. The largest number of births were registered in the months of July, October, August, and June, in order, and the smallest number in February. The smallest number of births was registered in February 1894 also, and in this month the lowest average has been recorded during the previous 10 years.

There were 538,540 deaths registered, equal to a death-rate of 28·61, as compared with 32·26 in 1894, and an average of 29·48 during the previous five years. There was a decline in the death-ratios in each of the registration districts, and in the case of Gujarat this decline was enormous. In that registration district, the recorded death-rate in 1895 was only 26·89, against 42·35 in 1894, and 34·48, the average of the previous 10 years. The falling-off was conspicuous in every collectorate of the district, but no explanation is given by the local Sanitary Commissioner. In only five collectorates in the Presidency, viz., Ahmednagar, Sholapur, Satara, Belgaum and Thar, and Parkar, were the death-rates in 1895 higher than the rates obtained in 1894. In rural circles, the average death-rate in 1895 was 28·26 per 1,000, against 31·98 in 1894; in the towns, the average death-rate was 31·18 against 34·27. In five towns the death-rates were in excess of 45 per 1,000, namely, Pandharpur, 69·86, Ahmednagar 54·26, Sangamner 50·45, Sholapur 47·98, and Barsi 46·95; in the remaining 51, the rates ranged from 38·47 in Nasik, to 15 in Mahad.

On page 18 of his report, the Sanitary Commissioner, Bombay, has arranged the 56 towns in two parallel columns. In the one column the towns are arranged in the order of the birth-rates from the highest to the lowest; in the other a similar arrangement is determined by the death-rates. If a line is drawn through the middle of both lists, it is found that in 28 of the towns the birth-rates were 33·67 per 1,000 or less, and in a like number the death-rates were 29·26 or less. But the towns in the lower division of each column do not correspond; 11 towns, in which the death-rates were over the average, show birth-rates under the average; for example, in Nasik, one of the highest death-rates in the Presidency was recorded (38·47), and the lowest birth-rate of any. It is commonly found in India that births are more likely to escape registration than deaths, but, just as there were 11 towns in which the death-rates were above the average and the birth-rates were below it, so there were, of course, 11 towns in which the birth-rates were above the average and the death-rates below it; for instance, in Gadag-Bettigeri, the birth-rate was 46·56 per 1,000, and the death-rate only 25·86. In some cases, were the birth-rates were low, and the death-rates comparatively high, a considerable deficiency of female population may be the cause. This is the case in Bombay, where, however, the recorded birth-rate calculated on twice the total female population is less than 26 per 1,000. In the other class of cases, where the population is considerable, and the excess of births over deaths is great, both rates being low, it is almost certain that registration is bad, and in such cases the cause should be readily detected and a remedy applied.

Among male infants, the death-rate per 1,000 living was 191·04, and among females 161·92; among boys between one year and five years of age, the death-rate was 53·56, and among girls 50·99. As in 1894, in the age-periods from five to 40, the female death-rates were the higher, over 40 the male death-rates were the higher.

The death-rate among Hindus was 30·87, among Christians and Muhammadans, the rates were in each class 20·55, and among "other classes" 13·88 per 1,000. The highest mortality, as in 1893, occurred in August, and the lowest in February.

The area under registration, which comprises the whole of Lower Burma, except the districts of Northern Arakan, Salween, and portions of the districts of Bassein, Toungoo, and Thayetmyo, with a total population, according to the census of 1891, of 4,516,599, remained unchanged, although alteration in district areas resulted from the breaking up of the Schwegyin district, and the formation of a new Thaton district.

The total number of births registered in 1895 was 131,147, equal to a birth-rate of 29·04 per 1,000 of the population, as compared with 27·62 in the previous year, and 24·48 the quinquennial mean. Although the rate obtained in 1894 was the highest recorded, and the rate for the past year is still higher, there is obviously much room for improvement in registration. As instances of the neglect of registration, the Civil Surgeon of Pegu, while on tour in the district, discovered that the foils relating to 1,072 births and 864 deaths, which had been made over to the police by the village headman, had not reached the office of the Deputy Commissioner; in the Shanywa village the Civil Surgeon saw at least 50 children under one year of age, but only 10 births had been reported; in Tharrawaddy the foils were not regularly collected owing, in some cases, to the neglect of the constables, and in others, to the village headmen not leaving the foils in the custody of responsible persons during their absence from their villages. The highest district birth-rates were 38·79 per 1,000 recorded in Sandoway, 34·94 in Tavoy, 33·34 in Mergui and 32·14 in Pegu, and the lowest rates were 25·41 per 1,000 registered in Toungoo, 24·40 in Thongwa, and 22·88 in Amherst. The average rate in rural circles was 29·71 per 1,000, as compared with 24·42 in the towns. The highest urban rates were 99·95 per 1,000, recorded in Letpadan, 52·25 in Zigon, and 49·18 in Thonze, all three small towns in the Pegu district. In Mergui a rate of 43·11 was registered, and in Myaungmya 40·63. The lowest rates were 11·56, recorded in Kyaukpyu, and 11·66 in Ramree. Although in Bassein the birth-rate was 30·09 per 1,000, in the other large ports the birth-rates were, as usual, very low, 18·33 in Rangoon, 19·03 in Akyab, and 21·91 in Moulmein. This is, no doubt, due in some measure to the excess of males among the population, but other causes are at work, as the birth-rates were not low in proportion to this excess, *e.g.*, in Bassein, the proportion of females to males is lower than in Moulmein. Considerable fluctuations in the percentage of males born to females were observed in the various districts; the average was 107.

The number of deaths recorded was 101,160, or an average of 22·40 per 1,000 of the population, as compared with 23·56 in 1894, and 19·73, the mean of the previous five years. This figure, although it has been exceeded only twice, is obviously very much below the true death-rate. The highest district death-rates were 31·27 and 26·54, registered, respectively, in Akyab and Thayetmyo, while the lowest was 15·88 recorded in Amherst. The average rate in the rural areas was 21·69, against 27·27 in the towns. The highest rates recorded in the towns were 58·58 registered in Letpadan, 45·75 in Myaungmya, and 44·31 in Thonze; in the remainder, with the exception of Gyobingauk, where the very low rate of 9·64 was recorded, the rates varied between 40·83 in Allanmyo and 13·59 in Schwegyin. The heaviest mortality occurred in July and August, and the least in March and February.

Among infants under one year of age the death-rate per 1,000 living among males was 208·37, and among females 150·71; among boys and girls over one year and under five years of age, the ratios were 33·31 and 28·61; at all age-periods, except those from 20 to 40, the male death-rates were the higher. For every 100 deaths of females, the deaths of 121 males were recorded. Among the various sects, by far the lowest death-rate was that of the Christians, 11·19 per 1,000; this was followed by 20·99 among Hindus; 21·39 among "other classes"; 22·68 among the Burmese or Buddhists; and 23·26 among the Muhammadans.

History of Chief Diseases.

Cholera.

The total number of deaths registered in 1895 as due to cholera, throughout India and Burma, was 320,979, against 529,049 in 1894, and 217,507 in 1893. As compared with 1894, there was a great fall in the mortality from cholera in Madras, Bombay, Bengal, and the North-Western Provinces and Oudh, while in the Central Provinces and Berar the rise was as notable. In the Punjab, the number of deaths rose from 113 in 1894, to 549 in 1895, and in Rajputana, from 2 to 1,049. In Assam, Central India, and Mysore, the numbers of deaths were much greater than in 1894, and in Hyderabad much less. In Ajmere-Merwara, where no death was registered in 1894, there were 289 in 1895, while in Coorg, where 8 deaths were recorded in the former year, no death was recorded in the latter.

In the following statement, the numbers of deaths registered in the various provinces in 1895 are compared with the numbers registered in the preceding 18 years:—

Statement showing the Deaths from Cholera in the different Provinces in India from 1877 *to* 1895.

Year.	Bengal.*	Assam.	North-Western Provinces and Oudh.	Punjab.	Central Provinces.	Berar.	Rajputana.	Central India.	Bombay.	Hyderabad.	Madras.	Mysore.	Coorg.	Lower Burma.	Ajmere-Merwara.
1877	155,305	11,377	31,770	29	3,418	842	60	926	57,228	7,414	357,430	2,902	‡	7,276	11
1878	95,192	6,732	22,221	215	40,985	34,306	2,393	8,047	46,743	6,696	47,167	723	49	6,750	210
1879	130,363	17,415	35,892	23,135	27,575	223	918	2,734	6,937	6	13,296	14	—	1,828	120
1880	39,613	2,803	71,546	274	330	1	—	299	684	—	613	25	—	2,638	3
1881	79,180	5,010	25,865	5,207	9,140	3,404	197	581	16,694	1,721	9,446	25	3	5,239	16
1882	182,352	21,055	89,372	39	11,932	3,573	1,327	1,562	7,904	150	23,604	893	31	7,177	289
1883	90,439	14,903	18,160	190	16,235	27,897	797	1,740	37,954	1,947	36,284	124	—	2,185	87
1884	134,421	22,276	30,143	614	119	87	1,297	1,018	13,894	2,479	75,176	330	—	5,515	227
1885	173,767	7,753	63,457	1,936	21,863	3,683	1,615	4,624	37,287	1,387	58,109	2,677	—	7,685	100
1886	118,368	20,188	34,565	12	16,679	976	173	290	167	499	12,417	10	—	4,027	765
1887	172,578	7,941	200,628	8,804	12,576	14,396	2,612	8,868	25,711	2,831	28,359	832	3	2,649	384
1888	111,391	9,693	13,701	14,938	921	305	32	191	36,500†	2,057	58,677	1,015	2	15,982	13
1889	171,103	18,288	48,494	2,838	52,588	10,925	6,923	3,344	32,431	1,128	76,020	1,590	9	3,240	55
1890	145,385	15,396	80,295	3,401	4,787	847	2,746	3,132	3,259	—	35,283	1,326	5	1,076	408
1891	229,575	23,882	169 013	10,107	21,312	7,958	2,946	13,474	17,850	3,102	98,773	1,204	7	2,400	532
1892	259,398	21,552	194,886	75,959	39,972	2,020	26,760	8,384	42,900	53	79,033	5,497	58	6,208	2,352
1893	126,976	21,849	12,154	639	557	1,188	314	127	18,853	165	32,209	680	9	2,393	3
1894	236,150	13,497	178,079	113	7,043	3,452	2	5,210	33,588	1,862	42,289	328	8	7,428	—
1895	177,087	18,962	51,562	549	15,506	11,919	1,049	6,043	8,890	467	21,172	2,334	—	5,150	289

* Excluding Calcutta from 1877 to 1892.

† Including four deaths, the monthly distribution of which is not known.

‡ Statistics not available.

The following table shows the seasonal distribution of fatal cases in the various provinces. The highest mortality occurred in the months of April and December, and the lowest in February and March:—

Statement showing the Deaths from Cholera registered in the different Provinces by months, during the year 1895.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of Deaths per 1,000 of Population. 1895.	1894.
Bengal	9,060	4,980	9,024	34,016	15,720	8,667	7,086	11,358	6,263	9,254	26,333	34,726	177,087	2·49	3·32
Assam	490	367	765	2,325	3,983	2,670	738	374	473	988	2,439	3,350	18,962	3·78	2·6
North-Western Provinces and Oudh.	2,839	383	1,207	7,864	8,734	4,111	3,654	2,793	2,854	3,072	7,295	6,726	51,562	1·10	3·80
Punjab	3	—	—	—	168	103	157	83	28	6	1	—	549	0·03	0·005
Central Provinces	6	117	277	713	1,424	2,090	1,901	3,568	2,883	1,683	501	163	15,506	1·03	0·74
Berar	106	308	600	700	1,308	1,833	3,415	2,501	922	174	18	34	11,919	4·2	1·2
Lower Burma	266	134	249	598	615	690	1,109	706	250	153	124	127	5,150	1·14	1·64
Madras Presidency	4,552	2,537	2,186	1,366	919	1,429	2,666	2,026	1,026	795	954	716	21,172	0·6	1·3
Bombay Presidency	37	19	30	140	532	985	1,306	1,652	1,043	1,052	1,485	609	8,890	0·47	1·78
Ajmere-Merwara	—	—	—	—	97	149	6	—	—	—	37	—	289	·53	—
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0·04
Mysore	74	312	316	204	762	411	121	111	7	14	2	—	2,334	48	0·07
Total	17,133	9,157	14,654	47,926	34,262	23,138	22,769	25,462	15,759	17,190	39,199	46,481	343,420	—	—

In the next table the mortality in each province in 1895 is compared with the mean mortality of the previous five years, 1890–94; the deaths registered in urban and rural circles are placed side by side; the percentages of villages attacked are shown;

the maximum mortality in rural and urban circles are contrasted, and the months of maximum prevalence in each province are indicated :—

Province.	Mortality in 1895.	Mean Mortality of previous Five Years.	Urban Mortality.	Rural Mortality.	Per cent. of Villages attacked.	Maximum Mortality in any one Rural Circle.	Maximum Mortality in any one Town.	Month of Maximum Prevalence.
Bengal - -	2·49	2·82	3·64	2·43	10·7	7·01	16·07	December.
Assam - -	3·78	3·83	4·72	3·76	15·8	8·32	22·89	May.
North-Western Provinces and Oudh.	1·10	2·73	0·66	1·15	5·8	7·54	8·20	May.
Punjab - -	0·03	0·88	0·01	0·03	0 2	0·54	0·37	May.
Central Provinces -	1·63	1·56	2·33	1·57	4·9	8·00	20·14	August.
Berar - -	4·2	1·0	3·2	4·3	10·8	10·3	14·9	July.
Lower Burma - -	1·14	0·87	1·14	1·14	7·0	3·32	8·20	July.
Madras - -	0·6	1·7	0·8	0·6	5·5	2·4	12·1	January.
Bombay - -	0·47	1·24	0·44	0·48	2·9	1·58	17·24	August.
Ajmere-Merwara -	·53	1·21	0·31	0·60	6·6	4·19	0·73	June.

The mortality ratios of this table are per 1,000 of population.

The number of deaths ascribed to cholera in Bengal in 1895 was 177,087, and the death-rate from this cause was 2·49 per 1,000 of the population, as compared with 3·32 in 1894, and 2·82 the average of the previous five years. The disease was present in every district during the year, although the mortality in the different districts varied greatly; in four districts, namely, Dacca (where the death-rate was 7·08 per 1,000), Faridpur (6·03), Nadia (5·36), and Jessore (5·35), the death-rates were over 5 per 1,000; and in four, namely, Saran (·26), Singhbhum (·23), Darjeeling (·15), and Lohardaga (·03), the rates were below 0·5 per 1,000. In the rural areas the average death-rate was 2·43, against 3·64 in the towns. Among the latter, the death-rates were highest in Kotrung, a small town in the district of Hoogly (16·07), Narayanganj, in Dacca (14·56), Kishorganj, in Mymensingh (13·36), and Ranaghat, in Nadia (12·22). In only 9 of the 147 towns was there no cholera death recorded; these were Dumraon, Revelganj, Lalganj, Chatra, Lohardaga, Daltonganj, Darjeeling, and Kurseong. Of these towns, Dumraon, with 18,384 inhabitants, is the largest. None are in the endemic area proper, and only three of them are on alluvial soil. In the province as a whole, the mortality was greatest in December (·48 per 1,000), April (·47), and November (·37), and least in February (·07) and September (·08). The least mortality occurred at the time that the rainfall was heaviest. This relation to the rainfall was, however, confined to Bengal proper, which on account of its preponderating population must, ordinarily, determine such statistics when the province is taken as a whole. In Bengal proper, the largest numbers of deaths occurred in December (·84), April (·82), and November (·57), while the smallest numbers occurred in August (·03), July (·04), September (·04), and June (·06). In Bihar, where the heavy falls of rain come somewhat later, the months of heavy rainfall were the months when the mortality was highest, August (·36), June (·22), July (·17), and September (·14), while the months when the death-rates were lowest were February (·002), January (·02), and March (·02). In Orissa and Chota Nagpur, the relation of death-rates to rainfall is less apparent. In Orissa the heaviest mortality occurred in November, October, and July; in Chota Nagpur the heaviest mortality occurred in April and May. In Orissa the least mortality was recorded in the months of May, January, and February, in Chota Nagpur the fewest fatal cases occurred in January and December, but in February, March, and November the rates were low.

Regarding means of prevention Dr. Dyson writes :—

"Filtered water-supply schemes are, of course, out of the question in small towns and villages, but I should like to see sanitary wells provided, by which I mean wells properly covered over so as to prevent the possibility of pollution, and provided with pumps, which should at first be worked for the convenience of the people at certain hours of the day by men specially employed for the purpose. These wells should, for the present, be provided by, and worked at the expense of, municipalities and district boards—one or two in each town and one in each selected village will be enough to begin with. At first there might be some caste and other prejudices against the use of the wells, but these would soon give way especially in times of epidemic when the people saw the advantage of the sanitary well water over that of unprotected sources, and the comparative immunity which it conferred upon those who used it. By such object lessons, I feel sure that the use of suspicious tank or well water would gradually be discarded in favour of the sanitary well, which the people would then, probably, provide for themselves."

These proposals have, at any rate, the merit of being practical.

The total number of deaths ascribed to cholera in Assam was 18,962, and the death-rate from this cause was 3·78 per 1,000, which, although much higher than the rate registered in 1894, which was 2·69, is less than the quinquennial mean, 3·83. Except in Nowgong, where the unusually low death-rate of ·91 per 1,000 was registered, the mortality from cholera was very severe in all the districts of the Brahmaputra Valley, ranging from 8·14 in Kamrup, to 5·40 in Lakhimpur, and 3·93 in Sibsagar. In the Surma Valley districts of Cachar and Sylhet, the death-rates were respectively 2·57 and 2·06, while in the selected areas in the Khasi and Jaintia hills the rate was ·71 per 1,000. The average death-rate in the districts, excluding the towns, was 3·76 per 1,000 In the tea gardens, where the sanitary condition of the labourers is generally well looked after, and the water-supply is often well protected, the average death-rate among the coolies was 4·60 per 1,000; in every district the death-rates among the tea garden coolies were higher than those ruling among the outside civil population. Dr. Stephen attributes this to the disease being introduced from time to time from outside by new comers. Assuming that cholera deaths among the outside population are as carefully recorded as they are in the tea estates, no further explanation of the greater mortality among the coolies seems to be required than that they, in their close communities, suffered more than they would if they dwelt scattered over a wide tract of country. In the towns the average mortality, 4·72 per 1,000, was considerably higher than the average among the tea garden populations. In Nowgong, and in the small town of Jowai, in the Jaintia hills, no death from cholera was recorded, and in Shillong there was only one, while in the small town of Mangaldai, 16 deaths yielded the enormous death-rate of 22·89 per 1,000. In the other towns, the death-rates ranged from 13·46 in Tezpur to 1·85 in Barpeta.

As in previous years, cholera was present in every district of the Surma and Brahmaputra Valleys in every month of the year. The mortality was greatest in May, December, June, November, and April in the order given. The pre-eminence of these months was due in April, May, and June to heavy mortality in Kamrup, in November to great prevalence of the disease in Goalpara, and, in December, to a severe outbreak in Sylhet.

The total number of deaths registered as due to cholera in the North-Western Provinces and Oudh was 51,562, equal to a death-rate of 1·10 per 1,000 of the population; this, though much lower than the death-rate of 1894, and the quinquennial mean, which were 3·80 and 2·73 respectively, is higher than seven of the death-rates recorded in the past 14 years. Among the districts, the highest mortality was 7·56 per 1,000 recorded in Hamirpur, followed by 5·51 in Fyzabad, 4·35 in Basti, 4·21 in Sultanpur, 2·85 in Gonda, 2·53 in Rae Bareli, 2·42 in Azamgarh, and 2·08 in Shahjahanpur. In Partabgarh, Benares, Mirzapur, Jaunpur, and Bijnor, the rates varied between 1·72 and 1·11. In the remaining districts, there was but slight mortality from the disease, and the hill tracts were absolutely free from it. In the rural areas, the average millesimal death-rate was 1·13, against ·65 in the towns. Of the larger towns, high rates were recorded only in Fyzabad (5·83) and Shahjahanpur (3·75). The smaller towns, however, suffered more severely, among them, Rath in the Hamirpur district, with a death-rate of 8·20 per 1,000, Ahraura (6·79), and Chunar (3·50), in Mirzapur, were most affected.

The most notable feature of the seasonal distribution of the disease was its unusual prevalence in January, when 2,839 deaths were registered, the highest number ever recorded in this month. The number of fatal cases fell to 383 in February, to rise to 1,207 in March, 7,864 in April, and a maximum of 8,734 in May; the number of deaths again fell to 4,111 in June and continued to fall until August; in September the number of deaths began to rise again, and the rise continued till November, when 7,295 deaths were registered; in December the number declined to 6,726.

Both the Hardwar and *Magh mela* fairs were free from any outbreak of epidemic disease.

There were 549 deaths registered as due to cholera in the Punjab in 1895, and the death-rate was ·03 per 1,000 as compared with ·005 in the previous year, and ·88 the quinquennial mean. The disease was practically confined to the districts of Umballa and Karnal, where 511 and 31 deaths, respectively, were recorded; there were 4 deaths in Peshawar, and one each in Delhi, Jhang, and Rawalpindi. The urban death-rate was ·01 per 1,000; only 12 deaths were recorded in the towns, 10 in Umballa and one each in Deli and Rawalpindi. There were 3 deaths in the province in January, 168 in

May, 103 in June, 157 in July, 83 in August, 28 in September, 6 in October, and one in November. In the last three months all the deaths were registered in Umballa.

The number of deaths ascribed to cholera in the Central Provinces in 1895 was 15,506, and the death-rate was 1·63 per 1,000, against ·74 in the previous year, and 1·56 the quinquennial mean. Every district in the province was affected; in Nimar, Narsingpur, and Chanda, the death-rates were respectively 7·37, 5·96, and 5·42 per 1,000; in both Murwara and Sambalpur the rates were only ·01; in the remaining districts they varied between 3·77 per 1,000 in Betul, and ·04 in Balaghat. In the rural areas the average death-rate was 1·57 per 1,000, as compared with an average of 2·33 in the towns. Thirty-two of the 72 towns escaped altogether, and in a good many the death-rates were low, but some towns suffered very severely, among them, Badnur (20·14), Lakhnadon (18·79), and Bhandara (15·81), had the highest death-rates. Deaths occurred in every month of the year; the disease was most prevalent in August, September, and June; least so in January, February, and December.

The number of deaths from cholera in Berar was 11,919 or 4·2 per 1,000 of the population, against 3,452 or 1·2 per 1,000 in 1894, and an average death-rate of 1 per 1,000 in the previous five years. Among the districts, the highest-rate was recorded in Basim, 10 per 1,000. The Sanitary Commissioner notes that in epidemic years this district suffers specially severely. "Why this should be it is difficult to explain. The "local sanitary conditions of the villages in the Basim district are, if anything, better "than those of the other districts of the province, so that local insanitary conditions do "not account for the comparative relative intensity of cholera epidemic in the district." Next to Basim came Buldana, with a death-rate of 5·8 per 1,000. In the other districts the rates ranged from 4·5 in Wun to 1·4 in Ellichpur. Of the 67 rural areas only one escaped, the Chandur circle, "the sanitary condition of which is perhaps "worse, and certainly not better, than many of those which suffered." The average death-rate in the rural areas was 4·3 per 1,000, against 3·2 in the towns. Of the 37 towns only 11 escaped, among the latter Sendurjana, Pusla, and Burroor, in which, in 1894, the cholera death-rates were respectively 18·9, 15·8, and 10·3 per 1,000. "This, "it is possible, may have been only a coincidence, or it may be that these towns had been "rendered immune or less liable to attack by the epidemic prevalence of the previous "year." In eleven towns the death-rates were higher than the provincial average, and in five the rates were over 10 per 1,000; these were Digras (14·9), Akot (12·6), Pusad (11·7), Bulgaon (11·4), and Umerkhed (11).

The disease was prevalent in every month of the year, and, except in October and November, the numbers of deaths were above the average. The peculiarity of the seasonal distribution of the disease was the unusual numbers of deaths which occurred during the early months of the year.

The number of deaths recorded as due to cholera in Madras was 21,172, and the death-rate was ·6 per 1,000, as compared with 1·3 in 1894 and 1·7 the quinquennial mean. Three of the districts, Godaveri, Kistna, and the Nilgiris, are reported to have been entirely free from the disease, while in four districts, Madura, South Arcot, Tinnevelly, and Tanjore, deaths occurred during every month of the year. The highest death-rates were 2·4 per 1,000, recorded in Tinnevelly, 2·0 per 1,000 recorded in Bellary and in South Arcot, and 1·9 per 1,000 recorded in Coimbatore. In the rural areas the average death-rate was ·6 per 1,000 compared with ·8 in the towns. Of the 92 towns 42 escaped the disease, and in 23 of the remaining 50 the rates were lower than the provincial mean. In some of the towns the mortality was very heavy, especially Ramnad (12·1), Chidambaram (11·6), Tenkasi (9·4) Periyakulam (7·0) and Kalladakurchi (6·8).

The largest number of deaths were registered in January, July, and February, the least in December, October, May, and November.

Although the number of cholera deaths in Coorg is rarely considerable, not a year, since 1886, has passed without some deaths occurring, except in 1895, when there was none; in the year before there were 8, and the quinquennial mean is ·10 per 1,000 of the population.

The total number of deaths recorded as due to cholera in Bombay in 1895 was 8,890, or ·47 per 1,000 of the population, as compared with 1·78 in the previous year, and 1·24, the average of the previous five years. As in 1894, the population of the districts in Sind enjoyed complete immunity from the disease; in Broach there was only one fatal

case, and in Surat only 5. In the remaining districts the rates ranged from 1·52 per 1,000 in Sholapur to 0·01 in Surat. The average death-rate in the rural areas was ·48 per 1,000 against ·44 in the towns. Rather more than half the towns escaped the disease, and in 14 others there were less than 5 cases. Some of the towns suffered severely; among them Pandharpur, where the death-rate was 17·24 per 1,000. In recent years but little has been done to improve the sanitary state of this town, the energies and money of the municipality being devoted to the construction of a high school and the building of a bridge. The Deputy Sanitary Commissioner writes :—

"The proceeds of the tax levied on pilgrims is spent on things which will not in any way benefit them, such as a large high school while nothing is being done to improve the water-supply, which during the July fair was in a very unsatisfactory state, there being but little water in the tank above the intake, and what there was being undrinkable; in addition very little is being done to improve the sanitary condition of the town, drainage works are almost at a standstill, while there is very much to be done. In my opinion the spending of the pilgrim taxes should be entrusted to a provincial committee and not to the municipality."

A very high death-rate, 8·79 per 1,000, was recorded in the town of Ranebennur, in Dharwar, and a rate of 4·54 in Gokak, in Belgaum.

There were only 37 deaths in the Presidency in January and 19 in February, in March there there 30, and in April 140, after that the mortality steadily increased to a maximum of 1,652 in August; there was a considerable falling off in the numbers of deaths in September and October, but in November the total again rose to 1,485, to fall to 609 in December.

The number of deaths ascribed to cholera in Lower Burma was 5,150, and the death rate 1·14 per 1,000, as compared with 1·64 in 1894, and ·87, the average of the previous five years. No district entirely escaped, but in two, Tharrawaddy, and Tavoy, there were only two deaths. The disease was most severe in the districts of the Arakan Division; in Akyab the death rate was 3·50 per 1,000, the highest rate in the province; in Sandoway, 3·16; and in Kyaukpyu, 2·23. The second highest district-rate was 3·29, recorded in Myaungmya, the newly-formed district in the Irrawaddy Division; the other districts in that division also suffered considerably, the death-rates having been 1·61 in Thongwa, 1·55 in Henzada, and 1·28 in Bassein. The only other considerable death-rate was 1·30, recorded in Mergui. The average death-rate in rural areas was 1·14 per 1,000, exactly the same as the average rate in the towns. Eleven of the 35 towns escaped altogether, among them Ramree and Gyobingauk, where the disease was specially severe in 1894. The highest rates were recorded in Myanaung (8·20), Allanmyo (5·44), and Akyab (5·32). The greatest number of deaths was recorded in July, and the least in February.

In the following paragraphs, compiled, for the most part, from the Cholera Registers of Regiments and Jails, are given certain facts relating to the occurrence of cholera among European and Native troops, and among prisoners.

Cholera appeared on 20 occasions among 17 bodies of European troops; there were 47 seizures altogether, and 35 deaths, a case-mortality of 74·47 per cent. In 13 instances there was only one case among the body of men attacked, 10 of these single cases were fatal, and in connection with the three that recovered, it may be noted that there was no cholera in their neighbourhood at the time. In only two instances were there more than four cases—in the Highland Light Infantry at Fyzabad, 16, and in various corps at Secunderabad, where seven men were attacked in April and May.

Among Native troops, cholera occurred in 24 stations, among the men and followers belonging to 30 different corps. In four regiments the disease appeared on two separate occasions. There were in all 94 men attacked, of whom 69, or 73·4 per cent., died. In 18 instances only one man was attacked, and in only six were there more than four cases.

Cholera occurred in 43 jails on 46 occasions. There were 142 cases and 89 deaths, equal to a mortality of 60·67 per cent. In 28 instances, one prisoner only was attacked, and 18 of these died. In only nine instances were there more than four men attacked, including 14 at Dinajpur, 14 in the Deccan Convict Gang, and 13 at Sandoway.

Diarrhœa was specially prevalent at the time of the occurrence of cholera among European troops on only one occasion, and at the time of its occurrence among Native troops on two occasions. One of these was the outbreak at Malegaon, where there were 17 cases of cholera and seven deaths, a case mortality of about 41 per cent.

Diarrhœa was specially prevalent in four jails, just before, or at the time of, the occurrence of cases of cholera.

The following statement shows, as nearly as possible, the number of buildings occupied by the various bodies of men attacked, and the proportion of these in which cases of cholera occurred:—

Communities.	Number of Buildings occupied by Bodies of Men attacked.	Number of Buildings which furnished Cases.	Percentage.
European troops - - - - -	227	33	14·53
Native troops - - - -	11,814	80	·68
Prisoners - - - - -	500	86	17·2

The disease occurred at different stations under various many meteorological conditions, but it is not possible to connect the occurrence of the outbreak with these.

Among the troops, in many instances, the men are supposed to have contracted the disease in the *bazar*, or from *bazar* supplies, but in no instances in which the disease was reported to have been introduced in this way, and assumed an epidemic form, could any connection be clearly established between the first and subsequent cases. The disease was stated to have been imported into four jails, but in only one instance does the direct connection of the first with subsequent cases appear probable

In the following statement are shown the numbers of persons actually in attendance on cholera patients, and the percentage of those attacked:—

Communities.	Number of Cases of Cholera treated.	Medical Officers, Hospital Assistants, and other Attendants on Cholera Cases.		Percentage of Attendants attacked.
		Number.	Number of these attacked.	
European troops - - - -	47	200	—	—
Native troops - - - - -	94	345	5	1·45
Prisoners - - - - - -	142	321	11	3·42

Three of the five persons seized while in attendance on native soldiers were attacked during the outbreak in the detachment of the 9th Bombay Infantry, at Malegaon, where diarrhœa was very prevalent; all three recovered. In another case the attendant was attacked a few hours after visiting the sick.

Small-pox.

The deaths from small-pox in India in 1895 numbered 45,733, or 1,673 more than in the preceding year. But this increase was not general; it was limited to Bengal, the Punjab, the Central Provinces, and the small province of Ajmere-Merwara. The mortality was heaviest in Ajmere-Merwara, Assam, and the Central Provinces, and lowest in the North-Western Provinces and Oudh, and Coorg. The relative increase of the disease was most marked in the Central Provinces, where no less than 6,644 deaths were recorded in 1895, against only 1,500 in 1894.

As usual, in most of the provinces the disease showed signs of activity first in February or March, and again in December. More than one-half the total mortality of the year occurred during the months of March, April, May, and December.

The following table shows the prevalence of small-pox in the different provinces of India in 1895, month by month:—

Statement showing the Deaths from Small-pox registered in the different Provinces, by months during the year 1895.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1895.	Total. 1894.	Ratio of Deaths per 1,000 of Population. 1895.	Ratio of Deaths per 1,000 of Population. 1894.
Bengal - -	611	923	2,163	2,642	1,798	1,195	944	515	421	357	556	895	13,020	8,404	0·18	0·11
Assam - -	143	201	422	497	609	473	357	238	121	150	279	359	3,849	3,997	0·77	0·80
North - Western Provinces and Oudh.	123	79	116	268	283	262	232	94	32	53	114	312	1,968	4,443	0·04	0·09
Punjab - -	457	321	377	705	993	899	550	370	256	369	949	2,088	8,334	6,068	0·41	0·30
Central Provinces	252	483	917	1,123	1,290	783	540	331	182	141	216	386	6,644	1,500	0·70	0·16
Berar - - -	51	97	99	91	80	59	20	4	2	4	9	40	556	1,061	0·2	0·3
Lower Burma -	78	200	198	262	271	173	149	80	44	31	14	40	1,540	1,737	0·34	0·38
Madras Presidency	415	421	469	477	468	334	380	450	427	354	401	515	5,111	11,207	0·1	0·3
Bombay Presidency	179	172	314	367	262	159	126	82	58	65	156	359	2,299	3,155	0·12	0·17
Ajmere-Merwara -	4	21	60	119	124	65	35	28	12	13	44	223	754	437	1·39	0·81
Coorg - - -	—	—	1	2	—	2	2	—	—	—	—	—	7	37	0·04	0·21
Mysore - -	117	139	179	138	171	174	163	166	105	66	85	148	1,651	2,014	0·34	0·42
Total -	2,430	3,057	5,315	6,691	6,349	4,578	3,498	2,358	1,660	1,503	2,823	5,371	45,733	44,060	—	—

The number of deaths recorded as due to small-pox in Bengal in 1895 was 13,020, or ·18 per 1,000 of the population. This rate, although it is insignificant when compared with the death-rates from other diseases prevalent in Bengal, is much higher than the death-rate of 1894, which was ·11 per 1,000, the lowest on record, and is considerably greater than the average of the ten years, 1885–94, which was ·15. There was a severe epidemic in Calcutta, where the death-rate was 3·25, the next highest district rate having been ·72, recorded in Faridpore. This district has been notorious for the opposition offered to vaccination by the people, headed by the influential sect of Ferazi Muhammadans. In order to overcome this, the provincial Sanitary Commissioner, towards the end of the year, sent one of his deputies, Dr. Deare, to the district. By his tact and perseverance, Dr. Deare has succeeded in winning over to a belief in the efficacy of vaccination, not only the Ferazi high priest, but most of the important religious leaders in Eastern Bengal, and, from October 1895 to March 1896, as many as 45,892 Ferazis were vaccinated. Death-rates over ·50 per 1,000 were recorded in Cuttack (·66), Howrah (·63), and Midnapore (·58), and in 13 districts the rates varied from ·38 to ·12; in Singhbhum there was no death; in the remaining 27 districts the rates ranged from 0·9 to ·002 per 1,000. The urban death-rate was ·91, as compared with ·14 in rural areas, and the towns showing the highest rates were North Dum-Dum in the 24 Parganas (3·65), Barnagore in the same district (2·21), and Birnagar in Nadia (2·04). Most of the high rates were registered in towns near Calcutta.

Although the number of deaths (6,631) among infants and children under 12 years of age was higher then in 1894 (5,652), the proportion per cent. of the total mortality (50·92) in 1895 was lower than in the previous year (67·25).

Among the European seamen in the port nine cases occurred, one of which was fatal, equal to a death-rate of ·69 per 1,000 against *nil* in the previous year, when only one man was attacked. Among the native floating population there were five deaths from small-pox, and the death-rate was ·19 per 1,000, as compared with ·03 in the previous year.

In Assam there were 3,849 deaths from small-pox registered during 1895, against 3,997 in 1894, and 2,021, the average of the previous five years. The death-rate was ·77 per 1,000, as compared with ·80 in the previous year. The highest district death-rate, 1·18 per 1,000, was recorded in Goalpara, where the disease was epidemic in 1893 and 1894. The Civil Surgeon of the district reports that the villagers persistently refuse to allow their children to be vaccinated. The next highest rate was 1·11 registered in Kamrup, mainly due to an epidemic in the town of Barpeta. In the other districts the rates ranged from ·96 in Sylhet to ·005 in Nowgong. The average rural death-rate was ·66 per 1,000, against 5·35 in the towns, where the number of deaths from small-pox rose from 61 in 1894 to 583 in 1895. Of the total, 483 were recorded in Barpeta, where the disease was introduced by a student who returned to his home from Calcutta. In Barpeta the last epidemic occurred in 1888, and as the

Mahapuryas, among whom the epidemic was almost entirely confined, refuse to accept vaccination, their children were quite unprotected. In Dibrugard, where the death-rate was 11·64 per 1,000, the first three cases of the disease were landed from a trading steamer from Calcutta. Vaccination is backward in this town, partly on account of superstitious opposition by the people, and partly on account of the floating nature of the population. In Sylhet, Dhubri, Nowgong, Shillong, Karimganj, Maulvi Bazar, Mangaldai, and Jorhat there was no death, and in the remaining head-quarter towns the rates ranged from 2·29 in Jowai, to ·18 in Gauhati and Goalpara. Among infants under one year of age there were 993 deaths, more than 25 per cent. of the total, and among children under twelve, 2,072 deaths, more than 53 per cent. of the total.

Up to 1892 the smallest death-rate from small-pox recorded in the North-Western Provinces and Oudh was ·16 per 1,000 registered in that year; in the following years the rate fell to ·13 in 1893, and 09 in 1894. In 1895 only 1,968 deaths were registered and the death-rate was ·04. No death was recorded in the district of Bijnor, and in 16 districts less than 10 deaths in each were registered. The highest district rates were 37, ·30, and ·27, registered respectively in Pilibhit, Kheri, and Jhansi. In only 27 among the 105 principal towns of the provinces did deaths from small-pox occur, and the urban and rural death-rates were practically identical. The highest ratios of mortality were recorded in Cawnpore ·35, Budaun ·20, and Kasganj ·19. Among infants under one year 580 deaths occurred, or about 29·5 per cent. of the total, and among children under 12 years of age 1,329, or about 67 per cent.

In the Punjab the number of small-pox deaths in 1895 was 8,334, against 6,068 in the previous year. The death-rate, which in 1893 was ·20 per 1,000, and in 1894 ·30, rose to ·41, or ·08 in excess of the quinquennial mean. The increase in small-pox mortality was due to an epidemic which began in the end of the year; the number of deaths, which had been 369 in October, suddenly rose to 949 in November, and to 2,088 in December. In four districts, Dera Ismail Khan (1·56), Hissar (1·52), Peshawar (1·33) and Gurgaon (1·06), the rates were over 1·0 per 1,000. In the remainder they ranged from ·94 in Umballa to ·001 in Gurdaspur. In the districts of Dera Ismail Khan and Peshawar the prevalence of the disease is ascribed to opposition to vaccination and to the operations of inoculators, and in Umballa to neglect of vaccination in small towns. In 12 of the towns, including Kaithal, Panipat, Jagraon, and Ferozepore, there was no death; in the others, death-rates ranged from 7·50 per 1,000 in Hansi, 5·28 in Peshawar, and 4·02 in Gujranwala, to ·01 in Amritsar. Among infants under one year of age 2,422 deaths occurred, or over 29 per cent. of the whole, and among children under twelve 5,244, or nearly 63 per cent.

The number of deaths from small-pox in the Central Provinces was 6,644, or ·70 per 1,000 of the population, as compared with death-rates of ·16 per 1,000 in 1894, and ·15, the average of the preceding five years. The death-rate of 1895 has been exceeded seven times in the last 22 years; in 1873 it was 1·37 per 1,000, in 1874, 2·38, and in 1875, 2·73; in 1878 and 1879 the rates were respectively 2·18 and 3·44 per 1,000, and in 1888 and 1889, 1·22 and 1·99. Not only was the disease more severe than in recent years, but it was very widely spread, as is shown by the occurrence of fatal cases in upwards of 85 per cent. of the registration circles. Among the districts the death-rates were highest in Nagpur (2·44 per 1,000), Jubbulpore (1·56), and Wardha (1·45). In Burhanpur only three deaths were recorded, in Nimar the death-rate (·08) was low, and in Mandla and Raipur the rates (·12 and ·15) were comparatively low. The average death-rate in the rural areas, ·58 per 1,000, was much less than in the towns, where the average was 1·96. In only 13 towns were there no deaths recorded, while in 16 death-rates over 3 per 1,000 were registered. The towns which suffered most were Tumsar (7·80), Charwa (6·71), Sindi (6·41), Harda (6·34), and Mohpa (5·68). The greatest number of deaths occurred in May, April, March, and June, in the order given. Of those who died, 2,019, or over 30 per cent. of the whole, were infants, and 2,964, over 44 per cent., children under 12 years of age.

In Berar the number of deaths recorded was 556, as compared with 1,061 in 1894, and the death-rate in 1895 was ·2 per 1,000, against ·3 in the previous year, and 1 the quinquennial mean. The highest district death-rates were ·4 in Buldana, and ·3 in Akola, and the lowest ·06 in Basim. Of the total number of deaths, 375 occurred in

rural districts, and 181 in the towns, in which the average death-rate was ·5 per 1,000. Among infants under one year of age, 205 deaths, or 36·9 per cent. of the total, occurred, and among children under twelve, 312 deaths, or 56·1 per cent.

The number of deaths from small-pox in Madras in 1895 was 5,111, and the death-rate was ·1 per 1·000 of the population, against ·3 in the previous year, and ·9 the quinquennial mean. The highest district rates were ·6 in Bellary, and ·5 in Anantapur. The lowest rate was ·006 recorded in the town district of Madras, where only three deaths occurred. In the Nilgiris also only one death occurred, but the rate was ·01 per 1,000. The next lowest rates were ·03, recorded in Coimbatore and in Malabar. As the latter district has been notorious for the prevalence of small-pox—the quinquennial death-rate is 2·6 per 1,000—the decrease in the mortality is the more gratifying. The death-rate in the rural areas was ·2 per 1,000, or just double the urban rate. The disease was present in the majority of towns, but the highest death-rates were only 1·6 per 1,000 recorded in Palkond, in Vizagapatam, 1·3 in Guntur, and 1·2 in Vellore. Of the fatal cases, 1,111, or 21·7 per cent. of the total, were infants, and 1,966, or 38·44 per cent., were children under 12 years of age.

In Coorg there were only seven deaths recorded, and the death-rate fell from ·21 in 1894 to ·04 in 1895, the mean ratio of the previous five years being 1·93. No deaths occurred among children under 12 years of age.

There were 2,299 deaths from small-pox in Bombay during 1895, and the death-rate was ·12 per 1,000 of the population, as compared with ·17 in the previous year, and ·15 the quinquennial mean. The disease was most severe in the collectorates of the Western Registration District, where the three highest death-rates were recorded, ·40 in Kolaba, ·37 in Nasik, and ·34 in Khandesh, and least severe in the collectorates of the Gujarat Registration District. In the Panch Mahal Collectorate there was no death, and in Kaira, Karachi, and Thar and Parkar the death-rates were only ·01 per 1,000. The average death-rate in rural areas was ·10, against ·25 in the towns, many of which escaped altogether. The death-rate in Alibagh, a small town in the Kolaba District, was very high, 5·95 per 1,000; a high rate of 3·34 was also recorded in Yeola, and comparatively high rates in Hyderabad (1·43) and Nandurbar (1·04). The number of infants that died was 613, or 26·6 per cent. of the total deaths, and of children under twelve 1,255, or 54·6 per cent.

There were 1,540 deaths from small-pox in Lower Burma during the year, and the death-rate was ·34 per 1,000 as compared with ·38 in 1894, and ·54 the mean of the previous five years. In the districts of the Arakan division there was only one death, in Akyab, and in Tenasserim there were only 28 deaths, of which 13 occurred in Mergui. There were 222 deaths in the Pegu Division, and 1,280 in Irrawaddy. In the last-mentioned division the death-rates were comparatively high in all the districts, ranging from 1·97 in Henzada to ·11 in Bassein. The disease has been prevalent in Irrawaddy for the last three years, the practice of inoculation is rife, and there is much opposition to vaccination. There was no death in 23 of the 35 towns; in Donabyu the death-rate was 4·00 per 1,000, in Zalun it was 2·33, and in Kyangin 1·11; in the remainder the rates ranged from ·97 in Kawkareik, to ·06 in Thayetmyo.

Among infants 348 deaths, or 22·6 per cent. of the whole, occurred, and among children under twelve 890, or 57·8 per cent.

Fevers.

The total number of deaths registered under the heading "Fevers," fell from 5,001,159 in 1894 to 4,266,293 in 1895. The decrease in mortality was specially notable in the North-Western Provinces, the Punjab, and Ajmere-Merwara, where the ratios fell to the extent of 8·57, 5·99, and 4·77 per 1,000 respectively. In only four provinces was there increased mortality; in Madras and Mysore the increase was slight, but in Assam and Coorg the millesimal ratios were respectively higher by 1·44 and 3·21. The provincial death-rates ranged from 23·48 in Coorg and 23·31 in the North-Western Provinces and Oudh to 8·3 in Madras and 7·67 in Mysore.

The minimum monthly death-rate was recorded in February, the rates rose till April to fall again in May and June; in the second quarter of the year the rates rose gradually, and in the last quarter rapidly to a maximum in December.

Statement showing the Deaths from Fevers registered in the different Provinces, by months, during the year 1895.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.		Ratio of Deaths per 1,000 of Population.	
													1895.	1894.	1895.	1894.
Bengal - -	149,532	110,429	114,205	150,630	119,439	103,808	115,736	113,094	128,755	146,181	160,261	222,184	1,634,254	1,799,833	22·99	25·32
Assam - - -	7,150	5,427	5,731	6,866	7,669	8,147	7,642	7,835	7,846	8,892	9,440	9,714	*92,359	†85,102	18·39	16·95
North - Western Provinces and Oudh.	105,416	71,734	64,665	75,229	84,407	72,589	67,103	81,166	91,876	121,131	127,408	130,483	1,093,212	1,495,372	23·31	31·88
Panjab - -	37,246	27,774	26,514	27,651	35,520	31,067	27,079	26,556	30,057	35,734	37,505	49,415	392,118	515,238	19·08	25·07
Central Provinces -	14,526	13,316	14,477	14,921	16,981	14,450	14,622	21,016	25,425	27,181	22.819	21,684	221,418	238,551	23·30	25·11
Berar - -	4,313	4,285	4,965	5,339	5,711	4,003	5,085	7,366	7,188	6,641	5,260	5,547	66,203	67,070	23·2	23·6
Lower Burma -	4,021	3,356	3,223	3,649	3,357	3,700	4,602	4,777	4,153	4,081	4,433	4,697	48,049	48,104	10·64	10·65
Madras Presidency	22,949	19,047	21,676	19,527	23,120	21,878	23,867	25,606	25,696	23,929	23,396	26,646	277,337	270,456	8·3	8·0
Bombay Presidency	31,747	28,438	31,392	31,304	30,657	28,468	32,306	36,795	34,490	33,009	32,935	37,307	388,848	429,094	20·66	22·80
Ajmere-Merwara -	1,041	975	1,185	1,060	1,012	587	679	761	904	789	1,047	1,223	11,263	13,855	20·77	25·54
Coorg - -	250	250	249	311	347	546	502	393	335	309	309	263	4,064	3,508	23·48	20·27
Mysore - - -	2,800	2,447	3,636	4,159	3,436	2,907	3,237	2,860	2,774	2,704	2,921	3,287	37,168	34,976	7·67	7·22
Total -	380,991	287,478	291,918	341,146	331,656	292,150	302,465	328,225	359,499	410,581	427,734	512,450	4,266,293	5,001,159	—	—

* Includes 15,894 deaths from Kala Azar.

† Includes 13,164 deaths from Kala Azar.

In Bengal the scheme for the sale of Government quinine through the medium of the Postal Department makes steady progress. The total number of post offices supplied with quinine increased from 2,321 in 1894 to 2,509 in 1895, the numbers of powders filled and packed during the year rose to 3,760,434 against 2,917,526 in the preceding year, and the amounts realised by the sale of pice packets aggregated Rs. 49,390 in 1895, as compared with Rs. 31,832 in 1894, and Rs. 18,047 in 1893.

The extension of the scheme to the North-Western Provinces and Oudh was sanctioned in December 1895 by the Government of India for all the districts in the Meerut Division, for the district of Pilibhit, and for the Tarai Perganas of Kichaha, Kilpuri, and Kashipur.

In Assam, from 1st October 1894 to 31st December 1895, quinine was sold through 137 post offices in the Brahmaputra Valley, and 82 post offices in the Surma Valley, and the total amount realised amounted to Rs. 703-14-0. In July 1896 the Government of India sanctioned the extension of the scheme to all post offices in Assam.

The number of deaths attributed to fevers in Bengal, in 1895, was 1,634,254, as compared with 1,799,833 in 1894. But although the death-rate of 1895, 22·99 per 1,000, exhibits a notable decrease when compared with that of the previous year, 25·32, it is considerably higher than the average of the five years, 1890–94, which was 20·81 per 1,000 of the population, and that again is higher than the average of the 10 years, 1885–94, which was 18·0. It is repeated that the serious progressive increase in the fever mortality in Bengal is due to the stoppage of natural drainage. However this may be, it is certain that the increase in mortality is generally distributed throughout the province: of the 46 districts, only two, Monghyr and Shahabad, show, in 1895, slight diminution in mortality, as compared with the average of the past 10 years; in each of the other 44, with the exception of Gaya and Noakhali, the increase is over 1 per 1,000, and ranges from 10·02 in Muzaffarpur to 1·34 in Murshidabad. These figures are the more significant of progression in the mortality, inasmuch as in 29 districts the mortality in 1895 is less than the previous year. The stoppage to natural drainage may be very largely responsible for augmented mortality, but unless such obstruction is general, it cannot alone account for so universal an increase. The districts which suffered most were Jessore (33·43 per 1,000 died), Dinajpur (32·83) and Jalpaiguri (32·56), while those which suffered least were Saran (13·89), Balasore (13·67), and Puri (6·92). The rural death-rate, 23·22 per 1,000, was, as might be expected, much higher than the urban rate, 18·43; both are lower than in 1894, when the rates were, urban 19·19, rural 25·63, but it is significant in connexion with the stagnation theory, that, while the urban rate is 6·14 per 1,000 higher than the decennial average, the rural excess is only 4·93. The highest urban

rates were 47·82 per 1,000, recorded in Chanduria, a small town in the Khulau district, 42·49 in Kumarkhali, a small town in Nadia, 39·01 in Malda, and 37·59 in Banshberia; the lowest rates were 5·73 recorded in Chapra, 6·76 in Jhalukati, 7·16 in Nalchiti, both small towns in Backergunge, and 7·95 in Tangail; in the remaining towns, the rates ranged from 36·53 in Birnagar, to 8·16 in Puri. The heaviest mortality occurred in the months of December, November, April, and January, in the order given, and the least in June, February, August, and March.

Under the heading "fevers" there were 92,359 deaths registered in Assam in 1895, and the death-rate, which was 16·95 per 1,000 in 1894, rose in 1895 to 18·39, or 2·21 per 1,000 in excess of the average of the previous five years. By far the highest death-rate was 37·17 per 1,000, recorded in Nowgong, where *kala-azar* is very prevalent; the next highest were 29·24 and 22·90, recorded, respectively, in Goalpara and Darrang. Excluding the selected areas in the Khasi and Jaintia Hills, the lowest recorded rates were 12·99 in Lakhimpur, 14·20 in Cachar, and 15·02 in Sylhet. In the rural areas, the average fever death-rate was 18 46, as compared with 15·49 in the towns. Among the latter, high rates were registered in Nowgong (37·18) and Mangaldai (35·77), and a very low rate in Shillong (3·42). In the remaining towns, the rates ranged from 24·87 in Golaghat, to 6·15 in Hailakandi. The greatest monthly mortality occurred in October, November, and December, and the least in February and March.

Kala-azar.—Regarding the distribution of this fatal form of fever the provincial Sanitary Commissioner writes:—

"There were 15,894 deaths reported from this disease in 1895, as against 13,164 in the previous year. As in 1894, there were a few *kala-azar* deaths reported from the Surma Valley and from the Sibsagar, Lakhimpur and the Khasi and Jaintia Hills districts, but almost all the deaths from this cause were registered in the Goalpara, Kamrup, Darrang and Nowgong districts. The disease is also still prevalent in the Garo Hills district. In the small portion of this district under registration, 38 *kala-azar* deaths were reported, as against 40 in 1894.

"In the Goalpara district there were 265 *kala-azar* deaths reported, as against 384 in 1894. Most of the deaths occurred on the left bank of the Brahmaputra river in the Goalpara and Salmara rural circles of registration. The disease is gradually disappearing from this district. In the Kamrup district the deaths fell from 2,149 in 1894 to 2,059 in 1895. The mortality from *kala-azar* in this district on the left bank of the river is diminishing gradually, but on the right bank, in the Barpeta and Nalbari rural circles, it continues to increase slowly. There were 2,477 *kala-azar* deaths registered in the Darrang district, as against 1,992 in 1894. Of the deaths registered, 2,405 occurred in the Mangaldai rural circle. The disease seems to be gaining a footing in the Tezpur circle.

"Of the 15,894 *kala-azar* deaths reported in the province, 11,037 occurred in the Nowgong district, being 2,452 more than the number recorded in 1894. Including deaths from *kala-azar*, there were 1,413 more fever deaths reported in this district than in 1894; but, excluding *kala-azar*, there were only 1,753 fever deaths reported, as against 2,792 in the previous year. It is not at all probable that the death-rate from malarial fevers in the Nowgong district was less than it was in the previous year, seeing that, in the neighbouring district of Sibsagar, the fever death-rate was nearly the same in both years. It is therefore highly probable that a considerable number of deaths which, in 1894, would have been returned as ordinary fever, were, in 1895, returned as *kala-azar*. I visited a large number of places in the Nowgong district during last touring season, and ascertained that the general opinion in most places was that *kala-azar* was distinctly less prevalent than it was in the previous year."

Owing to the very high death-rate from *kala-azar* in Nowgong, the continued prevalence of the disease in Kamrup, and its apparently increasing prevalence in the Mangaldai subdivision of the Darrang district, the Chief Commissioner applied to the Government of India for the services of an officer to make special inquiry into the nature of the disease. For this duty, Surgeon-Lieutenant L. Rogers was selected, and proceeded to Assam in April 1896.

In this Report for 1892, it was pointed out that the so-called *beri-beri* of coolies was not related to the disease of that name due to the manifestations of a specific peripheral neuritis, which is common in the Straits and Eastern Archipelago, and that the presence of the anchylostomum (*strongylus duodenalis*) although a possibly dangerous complication, was not the cause of the disease known as *kala-azar*, which, it was surmised, was probably related to malarial fever. So far, Dr. Rogers' investigations support these conclusions.

He finds that the anæmia of *kala-azar* differs from that of anchylostomiasis:—

(1.) In *kala-azar*, the hæmoglobin and the red corpuscles are nearly equally reduced; in anchylostomiasis, the hæmoglobin is reduced more than twice as much as are the red corpuscles.

(2.) In *kala-azar*, the proportion of white corpuscles to red is much reduced, except during the actual presence of fever, when there is a relative leucocytosis; in anchylostomiasis, the white blood-cells are relatively increased.

(3.) In *kala-azar*, the specific gravity of the blood is higher, relatively to the degree of anæmia present, than in anchylostomiasis.

In *kala-azar*, the degree of anæmia increases in direct proportion to the presence of fever, and to the height to which the temperature rises, the red corpuscles being destroyed, while the white cells seem to become gradually reduced in numbers. The bone marrow is found to be characteristically changed. A peculiarity of the fever of *kala-azar* is the comparative insensibility to its presence of the victims, who, when the temperature is as high as 103° F., will frequently deny that they have fever.

The number of deaths ascribed to fevers in the North-Western Provinces and Oudh in 1895, was 1,093,212, against 1,495,372 in 1894. The death-rate fell from 31·88 in 1894, to 23·31, as compared with 25·17, the quinquennial mean. The percentage of deaths described as having been due to fever was 80, but so many diseases are included that this figure is not of very great value as determining the mortality occasioned by malarial influences; and in 1895, many of the deaths were no doubt due to influenza, which was prevalent in several districts. Among the districts, the highest death-rates were registered in Kheri, 41·99, Naini Tal, including the Tarai, 40·06, Saharanpur, 39·23, and Pilibhit, 35·24; the lowest in Gorakhpur, 16·27, Rae Bareli, 15·59, and Partabgarh, 7·31. In the last-named the death-ratio under the heading "All other causes" was 10·4 per 1,000, as compared with the provincial average 3·11. In the rural areas, the average mortality was 23·20 per 1,000, against 24·79 in the towns. In only one of the larger towns, Muzaffarnagar (43·87), was the fever death-rate exceptionally high; but in some of the smaller towns, *e.g.*, Deoband (73·87), Gangoh (44·64), and Hapur (44·00), the mortality was very great.

"A very limited outbreak of typhus fever occurred in October in Kumaun and was investigated and reported on by Dr. Thorold. He came to the conclusion, which others have come to before, that defective ventilation and absolute absence of sanitation exist in nearly all these mountain villages. . . . . A slight outbreak also occurred in Garhwal."

There was a considerable reduction in the fever mortality in the Punjab, the number of deaths having fallen from 515,238 in 1894, to 392,118. The death-rate per 1,000 of the population was 19·08, against 25·07 in the previous year, and 26·81 the quinquennial mean. In 14 of the 31 districts, the rates were in excess of the provincial average, but in only two districts, Simla and Kangra, were the death-rates higher than the quinquennial mean. In most of the other districts, there was a considerable fall in the rates, as compared with the averages, and this was specially noteworthy in the district of Jhelum and in those districts lying between the rivers Jhelum and Sutlej. The highest death-rates were registered in Umballa (29·14), Kangra (24·37), and Kohat (23·85), and the lowest in Jhang (10·74), Shahpur (9·85), and Montgomery (9·26). In the rural areas, the average death-rate was 19·15 per 1,000, as compared with 18·03 in the towns. The highest rates among the latter were 29·20, recorded in Sonepat, and 26·94 in Jagadri; the lowest 9·28 in Chiniot, 9·13 in Jalalpur, and 7·78 in Ferozepore. In the other towns the rates varied between 24·78 in Delhi, and 10·06 in Ludhiana. The number of deaths in January was 37,246, the mortality fell to a minimum of 26,514 in March, rose till May to 35,520, when it gradually fell to 26,556 in August; it then rose steadily till December, when the maximum, 49,415 deaths, was reached.

In the Central Provinces the deaths from fevers numbered 221,418, or 17,133 less than in 1894. In that year, influenza was largely responsible for the high death-rates, and in 1895 this disease was also present in Saugor, Nagpur, and Bhandara, but it does not appear to have been very fatal. The fever death-rate, although it declined from 25·11 per 1,000 in the previous year, to 23·30, was considerably higher than the provincial mean, 20·92. The districts which suffered most were Nimar, death-rate 44·52 per 1,000, Saugor, 36·86, and Narsingpur, 32·16; while Chanda, 17·18, Raipur, 16·13, and Sambalpur, 7·67, were least affected. The average rural mortality was 23·68, as compared with 19·32 in the towns. Among the latter, the rates ranged from 57·35 per 1,000 in Charwa, and 41·51 in Rankheri, both small towns in the district of Hoshangabad, to 6·86 in Sambalpur town, and 3·51 in Narkher in the Nagpur district. The heaviest mortality occurred in the months of October, September, and November in the order stated, and the least in February.

The number of deaths from fevers in Berar, although less than in 1894, was unusually high; 66,203 deaths were registered, equal to a death-rate of 23·2 per

1,000, as compared with 23·6 in the previous year, and 17·7, the quinquennial mean. Among the districts, the rates ranged from 27·7 per 1,000 in Wun, to 21·2 in Amraoti, the average rural death-rate having been 23·3, against an average of 22·8 per 1,000 in the towns. Among the latter, the extreme rates recorded were 49·6 in Digras, in Wun, and 10·8 in the town of Karajgaon, in Ellichpur. Although the monthly death-rate followed the usual seasonal course, the highest having been registered in August and September, and the lowest in February and June, a remarkable feature was the occurrence of an exceptionally heavy mortality with an exceptionally light rainfall; ordinarily, when the rainfall is below the average, so also is the fever mortality, and *vice versâ*.

The number of deaths recorded as due to fever in Madras was 277,337, and the death-rate was 8·3 per 1,000, as compared with 8·0 in the previous year, and 7·8, the mean of the previous five years. In six of the districts, the death-rates were over 10 per 1,000, namely, the Nilgiris (19·2), Vizagapatam (18·2), Cuddapah (16·0), Kurnool (15·1), Madras Town District (14·2), and Ganjam (10·4). These figures are in fair agreement with the quinquennial averages, although in the Nilgiris and Vizagapatam, there is considerable increase, and in Kurnool, a decrease. In Vizagapatam, if these figures were correct, all the deaths, except 2·5 per 1,000, would be due to fevers, and in the Nilgiris, all but 5·7; in spite of the malarious character of these districts, this, as pointed out by the Sanitary Commissioner, is scarcely likely to be the case. The districts, whence the lowest death-rates were reported, were Tinnevelly (4·6), Anantapur (2·8), and Tanjore (2·3). The average mortality in rural areas was exactly the same as the average in the towns. In three towns, all containing more than 10,000 inhabitants, namely, Tadpatri in Anantapur, Dowlaishweram in Godaveri, and Rasipuram in Salem, no death from fever was recorded. In these towns, 486 of the total 501 deaths registered were returned under the heading "All other causes." In the remaining towns, the rates varied between 21·5 in Kampli in Bellary, and 0·5 in Viravanallur in Tinnevelly, and ·1 in Ramnad and Madura. The monthly mortality was fairly evenly distributed, but the death-rates in August, September, and December were highest, those in February and April lowest.

There were 4,064 deaths ascribed to fevers in Coorg, and the death-rate was 23·48 per 1,000 of the population, against 20·27 in 1894, and 19·52 in the five years preceding 1895. The rural rate was 24·20, against 16·12 in the towns. The heaviest mortality occurred in June and July, and the least in January, February, and March.

The total of deaths from fevers registered in Bombay was 388,848, which, although less by 40,246 than in 1894, is the highest recorded, except in that year and in 1892. The death-rate was 20·66 per 1,000, as compared with 22·80 in 1894, and 21·16, the quinquennial mean. Among the collectorates, the highest death-rates were recorded in Sholapur (30·75 per 1,000), Ahmednagar (28·33), and Satara (28·15), and by far the lowest in Ratnagiri (11·06), and Bombay City (7·86); in the remainder, the rates ranged from 27·39 in Khandesh to 14·89 in Kanara, and 13·35 in Hyderabad. The rural mortality was 21·36 per 1,000, as compared with 15·62 in the towns. Among the latter there were great divergences from the mean; the extremes were 40·67 in Barsi, a town of upwards of 20,000 inhabitants in the Sholapur district, and 6·05 in Junnar, a town of nearly 12,000 inhabitants in the district of Poona. In the cantonments of Deolali and Kirkee rates, respectively, of 4·79 and 4·91 per 1,000 were recorded. The heaviest mortality occurred in the months of August and December, and the least in February and June.

The number of deaths registered in Lower Burma under this heading in 1895 was 48,049, and the death-rate was 10·64, as compared with 10·65 in the previous year, and 9·66, the average of the preceding five years. The highest death-rates were recorded in the districts of Akyab, 21·28, Thayetmyo, 16·55, and Prome, 14·77; while the lowest were registered in Henzada, 7·37, Hanthawaddy (including Rangoon town) 5·80, and Thongwa, 5·75. In the rural areas, the average rate was 11·08, as compared with 7·57 in the towns. Among the latter, the highest fever death-rates were recorded in Kawkareik, 27·12, Pantanaw, 23·55, and Letpadan, 21·39. In Burma, generally, where the total death-rates are not exceptionally high, the recorded death-rates from fever vary inversely with the death-rates from "all other causes."

Dysentery and diarrhœa.

The number of deaths attributed to dysentery and diarrhœa throughout India during 1895 was 242,532, against 262,502 in 1894, but this decrease was confined to the Madras Presidency, to Bengal, the North-Western Provinces and Oudh, and the Punjab; in all the other provinces there was an increase, most marked in the Central

Provinces and Berar. The ratios ranged from ·76 in the Punjab to 8·6 in Berar, and in Madras, Lower Burma, and Ajmere-Merwara were almost identical with the rates recorded in 1894.

As usual, these diseases were most prevalent during the latter half of the year.

The following statement shows the distribution of the deaths from dysentery and diarrhœa in the different provinces, month by month, during 1895 :—

Statement showing the Deaths from Dysentery and Diarrhœa registered in the different Provinces, by months, during the year 1895.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.		Ratio of Deaths per 1,000 of Population.	
													1895.	1894.	1895.	1894.
Bengal - -	4,761	3,453	3,318	3,853	3,430	3,254	4,070	4,381	4,502	4,237	4,646	5,966	49,871	58,812	·70	0·82
Assam - -	1,139	797	895	1,238	1,423	1,526	1,109	1,190	1,363	1,461	1,787	1,595	15,523	14,769	3·09	2·94
North-Western Provinces and Oudh.	4,121	2,853	2,457	3,290	4,115	3,460	3,361	3,877	3,776	3,907	3,894	3,667	42,778	66,173	·91	1·41
Punjab - -	942	536	636	1,042	1,810	1,280	1,248	1,460	1,767	1,858	1,636	1,433	15,648	17,983	0·76	0·87
Central Provinces -	816	788	1,099	1,203	1,212	1,195	1,703	3,026	3,282	2,747	1,770	1,475	20,316	16,880	2·14	1·78
Berar - -	700	823	1,064	1,260	1,540	1,390	2,497	4,857	4,338	2,853	1,731	1,295	24,452	14,886	8·6	5·2
Lower Burma -	550	474	393	481	662	997	1,669	1,383	788	516	420	461	8,794	8,653	1·95	1·92
Madras Presidency -	2,023	1,576	1,487	1,370	1,774	1,980	2,263	2,769	2,583	2,094	2,006	2,012	23,937	24,801	0·7	0·7
Bombay Presidency	2,097	1,770	1,786	1,855	2,075	2,579	3,839	5,424	4,528	3,794	2,920	2,631	35,348	34,667	1·88	1·84
Ajmere-Merwara -	24	26	33	34	93	26	38	49	53	29	56	51	512	506	·95	·93
Coorg - -	6	12	18	23	44	61	54	31	36	45	21	16	367	184	2·12	1·06
Mysore - -	386	306	308	355	487	440	530	468	483	413	371	439	4,986	4,188	1·03	·86
TOTAL -	17,655	13,419	13,494	16,004	18,674	18,188	22,381	28,915	27,499	23,954	21,258	21,091	242,532	262,502	—	—

The number of deaths registered in Bengal in 1895 was 49,871, and the death-rate was ·70 per 1,000 of the population, against ·82 in the previous year, and ·68, the quinquennial mean. The districts in which the mortality was highest were the same as usual, although their relative order was somewhat altered, Calcutta (4·79 per 1,000), Howrah (4·65), Darjeeling (3·90), Balasore (3·21), and Puri (3·20). The lowest death-rates were recorded in Jessore (·04), Purnea (·03), and Rajshahi (·02). The urban mortality (3·52 per 1,000 was, as in past years, enormously greater than the rural (·55). Comparing the records of recent years, it appears that, while the urban mortality tends to increase, the rural mortality tends to decrease slightly. In 1895 the towns in which the highest death-rates were registered were, as last year, Bhadreswar, 11·61 per 1,000, and Serampore 11·48; these were followed by Nasirabad, 8·91, and Hooghly and Chinsura, 8·01. The largest numbers of deaths were registered in December and November, and the least in June.

In the Port of Calcutta, 104 European seamen were admitted to hospital, and four died, equal to a death-rate of 2·79 per 1,000 of strength.

There were 15,523 deaths registered in Assam as due to these causes in 1895, and the death-rate was 3·09 per 1,000, against 2·94, the death-rate of the previous year, and 2·95, the quinquennial mean death-rate. In accordance with the experience of previous years, the highest death-rate, which was 7·79 per 1,000, was registered in Lakhimpur, the next highest rates, 5·12 and 4·58, were registered respectively in Sibsagar and Cachar, while the lowest rates were recorded in Goalpara ·97, and Kamrup ·91. The rural death-rate was 3·01, as compared with 6·75, the average rate in the towns. Among the latter the highest rates were recorded in Golaghat (13·57), Dibrugarh (13·27), Tezpur (10·47) and Dhubri (10·16), and the lowest in Shillong (1·64), and Hailakandi 1·54). The greatest mortality occurred in November, and the least in February.

The total number of deaths ascribed to these causes in the North-Western Provinces and Oudh in 1895 was 42,778 against 66,173 in the previous year, and the death-rate was ·91 per 1,000, as compared with 1·41 in 1894, and 1·07 the quinquennial mean. As usual the highest rates were returned from the hill districts, Garhwal 9·73, Almora 4·83, Dehra Dún 4·88, and Naini Tal 2·10. In the plains the highest district rates were 3·12 per 1,000 in Jhansi, 2·85 in Rae Bareli, and 2·36 in Bareilly, while the

lowest rates were ·09 in Basti, ·08 in Kheri, and ·06 in Bahraich and Mainpuri. The rural death-rate fell from 1·25 in 1894 to ·80, as compared with 2·35 in the towns, where, in 1894, the average rate was 3·62. In Kashipur, in the Tarai, the death-rate was as usual highest, although the 12·84 per 1,000 of 1895 compares favourably with the 15·49 recorded in 1894, and the 19·37 of 1893. Very high rates were registered in Nagina 8·71, Bulandshahr 7·15, Hathras 7·02, Atrauli 7·01, and Moradabad 6·96. The greatest mortality occurred in the months of January and May, and the least in February and March.

There were 15,648 deaths attributed to these causes in the Punjab in 1895, and the death-rate was ·76 per 1,000 of the population, against ·87 in the previous year, and ·83 the quinquennial mean. The highest death-rate was recorded in the Simla district, where the mortality rose from 2·07 in 1894 to 3·26 in 1895, as compared with an average of 1·63 in the previous five years. No explanation of this increase is given. The next highest rate was 1·70, recorded in Umballa, while the lowest rates were ·14 and ·19 registered respectively in the districts of Kohat and Dera Ghazi Khan. The average urban death-rate was 2·33 per 1,000, as compared with ·64 in the rural areas. The town in which the highest rate, 7·60 per 1,000, was registered, was Umballa, followed by Pind Dadan Khan with 5·78, and Karnal with 5·48; in only two towns, Gujranwalla (·97) and Sirsa (·49), were the rates lower than 1 per 1,000. As usual, the mortality was heaviest in September, October, and November.

The number of deaths registered under this heading, in the Central Provinces, was 20,316, and the death-rate per 1,000 of the population, which was 1·78 in 1894, rose to 2·14, as compared with the quinquennial average of 1·81. The districts in which the highest death-rates were recorded were Jubbulpore (4·65), Hoshangabad (4·60), and Narsingpur (4·40); while the lowest rates were registered in Balaghat (·55), Burhanpur (·53), and Bhandara (·30). The average death-rate in towns from these causes was 3·19 per 1,000 against 2·04 in the rural areas. In the former the rates varied enormously; in one small town of 5,000 inhabitants, Mohari, there was no death from dysentery and diarrhœa, while in Damoh (11,753 inhabitants), 227 deaths yielded a death-rate of 19·31 per 1,000. In the other towns the rates varied from 10·57 per 1,000 in Badnur to ·26 in Ramtek. The heaviest mortality was recorded in September (3,282 deaths) and August (3,026), and the lightest in February (788).

The total number of deaths registered as due to these causes in Berar in 1895 was 24,452, and the death-rate was 8·6 per 1,000, as compared with 5·2 in the previous year and 5·4 the mean death-rate of the previous five years. Ellichpur, as usual, headed the districts with a death-rate of 13·8 per 1,000, which has not been surpassed during the last 23 years, the next highest rate was 10·3 registered in Akola; this has been exceeded four times since 1868, namely, in 1874, 1876, 1883, and in 1878, when the mortality from dysentery and diarrhœa in this district reached the enormous rate of 24 per 1,000. By far the lowest rate, 2·8 per 1,000, was recorded in Wun. The average rate in rural areas was 9·0, as compared with 6 per 1,000 in the towns, among which the highest rates recorded were 15·6 in Nandura, 14·0 in Anjangaon, 13·1 in Mehkar, and 13·0 in Ner Pinglai. Contrasting with these high figures were death-rates of ·9 per 1,000 registered in Nandgaon Pett, and ·3 in Mangrul Dastgir. The monthly maxima were attained in August and September, and the minima in January and February.

The total number of deaths registered under this heading in Madras in 1895 was 23,937, and the death-rate, ·7 per 1,000, ·1 per 1,000 less than the quinquennial mean, was practically identical with the rates registered in 1894 and 1893. Excluding the Madras town district, where the rate was 4·9 per 1,000, the highest rates were obtained in the districts of Chingleput (1·9), Malabar (1·6), and South Canara (1·3), while the lowest rates were registered in Anantapur (·3), Kistna (·3), and Kurnool (·2). The urban rate was 2·9, as compared with ·5 in the rural areas, the towns showing the heaviest mortality having been Vizagapatam (10·3), Karur (7·6), and Tuticorin (6·3), places where to foul and damp sites, brackish polluted water supplies are added. In 12 considerable towns, with populations in excess of 10,000, there was no death from dysentery and diarrhœa recorded. The heaviest mortality occurred in August and the least in April.

In both 1893 and 1894 the deaths under this heading, recorded in Coorg, numbered 184, in 1895 the number was almost exactly doubled, and 367 deaths were registered, equal to a death-rate of 2·12 per 1,000, as compared with a quinquennial average of

1·23. In the rural areas the average rate was 1·53 per 1,000, as compared with 8·12 in the municipal towns. The largest number of deaths occurred in June and July, the least in January.

During 1895 the number of deaths from these causes in Bombay was 35,348, yielding a death-rate of 1·88 per 1,000, which is very slightly higher than the rate, 1·84, recorded in the previous year, but decidedly higher than the quinquennial mean of 1·73. The highest district rates were recorded in Sholapur (4·34), Satara (3·88), Belgaum (3·65), and Nasik (3·64), and the lowest in Hyderabad (·12), Thar and Parkar (·06), and Shikarpur (·06). As usual, all the district rates recorded in the Sind and Gujarat Registration Districts were low. The average rate obtained in rural areas was 1·86 per 1,000 against 2·04 in the towns. Among the latter the highest rates were registered in Pandharpur (9·37 per 1,000), Ahmednagar (7·77), Satara (7·50), and Chopda (7·28). The largest number of deaths occurred in the month of August, and the smallest number in February.

Although the number of deaths from dysentery and diarrhœa in Lower Burma, which was 8,794, is the highest on record, it is pointed out that this is an indication of improved registration and not of an unhealthy season. The death-rate from these causes was 1·95 per 1,000 of the population, against 1·92 in the previous year, and 1·21 the average of the previous five years. The highest district rate recorded was 4·40 per 1,000 in Akyab, closely followed by 4·38 in Tavoy. In the other districts the rates of mortality ranged from 3·55 in Bassein to ·44 in Henzada. In the rural areas the average death-rate was 1·87 against 2·46 the average in the towns. In the small towns of Gyobingauk and Donabyu there was no death; among the remaining towns the rates varied, Allanmyo (6·32 per 1,000) and Sandoway (5·14) being at the head of the list, and Zalun (·33) and Shwedaung (·16) at the bottom. By far the largest numbers of deaths were registered in July and August, and the smallest numbers were registered in February, November, and March.

Injuries. In all there were 94,560 deaths from injuries or 1,140 more than in the preceding year. This increase was distributed over seven provinces, but it was in the North-Western Provinces and Oudh that the excess was highest, having numbered no less than 3,123. The ratio of mortality ranged from ·21 per 1,000 in Lower Burma to ·66 in the North-Western Provinces and Oudh and ·76 in Ajmere-Merwara.

All other causes. The number of deaths recorded under "All Other Causes" was 1,282,141 against 1,394,879 in 1894, but in Assam, Berar, Madras, Coorg, and Mysore, the mortality thus classified was higher than in the preceding year.

Vaccination.

The total number of vaccinations performed in 1895–96 among the civil population throughout British India by all the agencies combined was 7,912,086, or 295,226 more than in 1894–95. This increase was confined to primary operations; in re-vaccinations there was a falling off as compared with the preceding year. Out of the total, 7,297,331 were primary operations, of which 6,868,740 proved successful, and 614,758 were re-vaccinations with success in 370,579 cases. In all the provinces, with the exceptions of Madras, the Central Provinces and Berar, the numbers of vaccinations were greater than in the previous year.

As in the two preceding years the average number of operations performed by each vaccinator was highest in the Punjab and lowest in Bengal. In the operations performed by the special establishments the proportion of success in primary cases varied between 98·52 per cent. in Bengal and 87·0 in Madras, and, in re-vaccinations, between 87·98 in Assam and 23·4 in Berar. In the vaccinations performed in dispensaries the percentage of success in primary cases was highest in Bengal (95·40), and lowest in the North-Western Provinces and Oudh (75·48) and Coorg (61·73); and in re-vaccinations it ranged from 82·26 in Assam to 37·78 in Lower Burma and 28·0 in Coorg.

Except in the Central Provinces and Upper Burma the numbers of infants protected by vaccination were, in every province, greater than in 1894–95. The total number of children under one year of age who were successfully vaccinated was 2,751,764, and of those between one and six years of age 3,372,925, the corresponding figures for the preceding years having been, respectively, 2,692,885 and 3,200,454. As noted in the report for 1894–95, the state of infant vaccination is still backward in Bengal, Assam, Madras, Coorg and Burma. The ratio of successful vaccinations per 1,000

of population was greater than in 1894–95 in every province, excepting the Punjab, Central Provinces, Berar and Madras.

The following comparative statement shows the main features of the working of the Vaccination Department during the years 1894–95 and 1895–96.

Comparative Statement of Vaccination in the different Provinces of India, excluding Ajmere-Merwara, in 1894–95 *and* 1895–96, *together with the death-rates from small-pox during* 1894 *and* 1895.

Province.		Population.	Number of Vaccinations performed.			Percentage of Successful Cases.		Persons successfully vaccinated per 1,000 of population.	Ratio of deaths from small-pox per 1,000 of population during the calendar years 1894 and 1895.	Average number of vaccinators employed in Department.*	Average number of operations per vaccinator*
			Primary.	Re-vaccinations.	Total.	Primary.	Re-vaccinations.				
Bengal	1894-95	71,092,454	2,106,142	67,955	2,174,097	98·23	30·84	29·40	·11	3,291	525
	1895-96	70,761,383	2,227,932	49,149	2,277,081	97·84	41·85	31·09	·18	3,380	639
Assam	1894-95	5,634,258	189,334	4,445	193,779	87·42	61·60	29·86	0·80	230	789
	1895-96	5,634,258	237,119	7,149	244,268	97·63	87·62	42·20	0·77	228	1,025
North-Western Provinces and Oudh	1894-95	47,146,033	1,398,054	25,649	1,423,703	89·46	63·23	26·83	·09	828	1,718
	1895-96	47,146,033	1,437,790	61,463	1,499,253	90·89	59·19	28·49	·04	854	1,754
Punjab	1894-95	20,553,982	652,653	250,202	902,855	93·73	47·56	35·55	0·30	298	3,022
	1895-96	20,724,940	693,744	229,431	923,175	93·10	56·72	37·44	0·41	300	3,077
Central Provinces	1894-95	12,131,300	432,280	56,585	489,265	96·27	77·80	37·96	0·16	257	1,816
	1895-96	12,173,345	397,261	68,214	465,475	96·22	81·97	35·99	0·70	257	1,740
Berar	1894-95	2,897,040	93,296	21,343	114,639	94·67	23·14	32·19	·3	44	2,605
	1895-96	2,897,040	92,694	13,911	106,605	95·92	23·43	31·81	·2	44	2,423
Lower Burma	1894-95	4,658,627	155,528	52,532	208,060	90·96	47·90	35·77	·38	77	2,677
	1895-96	4,658,627	216,795	28,306	245,065	91·22	45·74	45·22	·34	123	1,974
Upper Burma	1894-95	3,474,361	115,736	4,084	119,820	88·97	46·28	30·18	—	48	2,393
	1895-96	3,488,228	118,543	2,135	120,678	92·63	67·73	31·89	—	54	2,143
Madras	1894-95	35,830,282	1,116,820	82,102	1,198,922	91·60	75·44	30·28	0·3	806	1,455
	1895-96	35,651,577	1,120,625	77,546	1,198,171	91·22	75·24	30·31	0·1	842	1,383
Bombay	1894-95	22,701,942	710,957	58,820	769,777	93·34	58·12	30·74	0·17	431	1,779
	1895-96	22,701,942	730,108	75,216	805,324	93·09	57·80	31·85	0·12	434	1,854
Coorg	1894-95	173,055	7,276	1,311	8,587	90·50	73·15	43·59	0·21	9	868
	1895-96	173,055	9,173	1,840	11,013	94·95	81·52	58·52	·04	9	1,157
Total	1894-95	226,293,334	6,978,076	625,428	7,603,504	93·68	53·14	30·26	·19†	—	—
	1895-96	226,010,428	7,281,748	614,360	7,896,108	94·12	60·26	31·96	·20†	—	—

* Refers to Special Vaccination Establishment only.
† Calculated on figures taken from Sanitary Reports excluding Upper Burma.

During the year 1895–96 the supervising staff in Bengal consisted of three Deputy Sanitary Commissioners, 48 Civil Surgeons, 211 Native Superintendents and 13 Head Vaccinators, and the Vaccinating Staff, of 157 operators paid by Government, 67 paid by district boards, 281 attached to municipalities, dispensaries, etc., and 3,156 licensed men, who are not paid from public funds, but are allowed to make a small charge for each operation, their work being controlled by the Department. The total number of operations performed throughout the Province increased from 2,174,097 in 1894–95 to 2,277,081, of which 2,179,900 were successful cases of primary vaccinations and 20,572 successful re-vaccinations. In primary operations the percentage of success reported was 98·39; this, though slightly lower than in the preceding year, is still incredibly high, and is attributed mainly to the exclusion of failures from the returns, but, in a measure also, to classifying as successful, not only in cases in which success had been only partial, but even absolute failures. In this connection, the provincial Sanitary Commissioner having pointed out that in Bengal only two punctures in each arm are made, whereas in the Punjab the three punctures in each arm give a better chance of success, and that no information regarding the numbers of good cicatrices obtained in each case is furnished, the Lieutenant-Governor has accepted the suggestion that, in future, three punctures shall be made in each arm, and that the returns shall show exactly how many points in each case of vaccination have succeeded. The percentage of success in re-vaccination was 50·04 against 36·83 in the previous

year, and 51·26 in 1893–94. Instancing the remarkable disappearance of small-pox from Prussia, Dr. Dyson urges on Government and local bodies the importance of providing that every boy entering school and the public service should be vaccinated or re-vaccinated.

In recent years a distinct advance has been made in the protection of infants. In 1892–93 the percentage of the estimated number of infants born who were vaccinated successfully was 11·4, in 1893–94 it was 12·9, in 1894–95 the percentage rose to 14·2, and during last year to 14·7.

Of the different agencies the vaccinators employed by the district boards displayed the greatest energy, the average number of operations performed by each man having been 881, while the municipal vaccinators did least work, their average having been only 424 per man.

The number of operations verified by the Deputy Sanitary Commissioners was only ·86 of the whole, but it must be remembered that these officers have to carry on their inspections in the most inaccessible parts of the province. Civil Surgeons verified 8·8 per cent. of the numbers vaccinated; five officers inspected over 10,000 cases each, among them, Surgeon-Major Peck, who inspected 13,997 cases, and Surgeon-Lieutenant-Colonel Russell, who inspected 13,487. The proportion verified by District Inspectors was 32·77 per cent., and by the Sub-Inspectors 62·52; the quantities of work done by these subordinate officers were very unequal.

Vaccination was carried on with humanized lymph, with fresh calf lymph, and with calf lymph mixed with lanoline, but no comparison of the relative value of these is possible, as the "erroneous practice of excluding unsuccessful operations and including "repetitions in the arm-to-arm method is still in vogue." Dr. Dyson advances strong reasons for the exclusive use of calf lymph. The general advantages of this method are, of course, well known, but the difficulty in obtaining infants as vaccinifers, and the practical certainty that those obtained are the children of poor low-caste parents, are among the disadvantages peculiar to India of the arm-to-arm method.

The most notable event in the year was the success attending the efforts to introduce vaccination among the Ferazis of Eastern Bengal. The Ferazis are a strait sect of Suni Muhammadans. Among their religious tenets is the prohibition of vaccination, on the grounds that prophylactic measures should not be taken against disease, and that it is a sin for a Mussulman to have pus or blood injected into his body; and, among their superstitions, the belief that Government has instituted the practice of vaccination in order to detect and capure a future ruler, now living among them, in whose veins milk flows, and not blood! Hitherto the Ferazis have resisted vaccination in the most determined manner, and their communities have suffered much from smallpox. By patient endeavour, beginning with the high priest, Dr. Deare succeeded in inducing no less than 36,240 of the sect to allow themselves to be vaccinated with lanoline-lymph. The introduction of vaccination among the Ferazis in other districts has followed the successful efforts made in Faridpur.

While the number of vaccinators employed in Assam during 1895–96 was slightly less than in the preceding year, the number of operations performed by them rose from 181,477 to 233,812, the average number performed by each man having risen from 789 to 1,025. Of these 227,114 were primary vaccinations, and 6,698 cases of re-vaccination, and the percentages of success were 97·74 and 87·98 respectively, as compared with 87·80 and 61·25 in 1894–95. The high rate of success reported in primary vaccinations is attributed to the improvement in the lymph supplied from the depôt at Shillong, but the results are considered by the Chief Commissioner to be suspiciously good; he doubts the accuracy of the figures, and is inclined to believe that unsuccessful operations are excluded from the lists in parts of the province. No explanation of the very high percentages of success in re-vaccination attained in all the districts is given. The number of operations performed by medical officers and subordinates attached to the dispensaries fell from 12,302 in 1894–95 to 10,456 in 1895–96. Of these 10,005 were primary vaccinations and 451 re-vaccinations, and 95·08 and 82·26 per cent. respectively were successful. Besides these operations, 16,422 primary operations, upwards of 10,000 more than in 1894–95 were performed by private agencies on tea estates, and 86·74 per cent. were successful.

There were 47,176 infants under one year of age protected against 40,082 in the preceding year, and 37,112 in 1893–94.

Inoculation is still practised in parts of the Surma Valley and in the Lakhimpur district. In May 1895 two persons were charged in the Court of the Deputy Commissioner of Cachar, the one for causing death by a rash and negligent act, in that he inoculated a child with small-pox from which it died, and the other for doing

a negligent act likely to spread infection of a disease dangerous to life, in having inoculated certain children, one of whom contracted small-pox and lost his eye-sight. They were each sentenced to a week's imprisonment and a fine of 20 rupees. On appeal the Sessions Judge remitted the sentence of imprisonment, but the fines were allowed to stand.

The bovine lympth depôt at Shillong was worked satisfactorily during the year, and there was no complaint made of the quality of the lymph supplied. In view however, of the supply proving insufficient, orders have been issued for the use of fresh calf lympth at each district head-quarters. It was found in the depôt that lanoline-lymph paste of a strength of 1 in 6 gave better results, and was more certain, than the methods previously in use, and it was also observed that punctures produced better vesicles on the calf than scarification.

The average number of vaccinators employed in the North-Western Provinces and Oudh in 1895–96 was 854, against 828 in the previous year, and the number of operations performed by each man rose from an average of 1,718 to 1,754. The number of operations performed was 1,497,899, of which 1,436,591 were primary and 61,308 re-vaccinations, the percentages of success having been 94·87 in the former and 66·02 in the latter, as compared with 93·68 and 63·22, in 1894–95. Besides these, the medical subordinates attached to dispensaries performed 1,199 primary operations, of which 75·48 per cent. were successful, and 155 re-revaccinations, of which 41·93 per cent. succeeded. The number of infants protected during the year rose from 562,481 in 1894–95 to 570,227, or 30·2 per cent. of the estimated births of the year.

Although the Vaccination Act is in force in all the municipalities, it is not worked so efficiently as it ought to be. The vaccination register, which should be kept up by the municipal authorities, is practically the same as the birth register; but the birth registers are generally defective, so that children escape being vaccinated, while the work of keeping up the vaccination register is frequently performed by the vaccinators themselves. The number of operations verified by the Deputy Sanitary Commissioners and Civil Surgeons was 145,086 or 9·68 per cent. of the total, and the number verified by the Assistant Superintendents of Vaccination and other inspecting officers was 446,827, or 29·83 per cent. of the whole. The percentage of cases found to be successful by the former was 95·10, and by the latter 94·18, while the success claimed by the vaccinators was at the rate of 93·77 per cent. only. With the exception of the depôt at Lucknow, none of the lymph depôts in the province seem to have been worked altogether satisfactorily. A scheme is being considered for the extension of the operations of the Lucknow depôt during the cold season, and for the establishment of a similar depôt in the hills, whence lymph can be obtained by such persons as require it during the recess season, and from which supplies for the commencement of operations throughout the province, in September, can be sent.

Small-pox broke out in epidemic form in the autumn of 1895, and was most severe in the south-eastern and southern districts. Very soon it was noticed that large numbers of adults, who had been vaccinated, suffered from the disease, although in a slight and modified form, and special efforts were made to extend re-vaccination, with the result that the number of successful re-vaccinations rose from 16,203 in the preceding year to 36,318.

The supervising staff in the Punjab remained numerically the same as in 1894–95, viz., one Deputy Sanitary Commissioner, six Divisional Inspectors, and 34 Native Supervisors, but the average number of vaccinators employed, including 21 belonging to the special staff, and six employed in cantonments, was 300 in 1895–96, or four fewer than in the previous year. During the year a new system was introduced to secure more systematic working of the operators, greater thoroughness in the work, and more reliable statistics regarding it. Under this system the vaccinators began their work in bodies, each under the control of a supervisor, who is responsible for the quantity and quality of the work. The agency is under the general supervision of the Civil Surgeon, who is to see that his district is thoroughly traversed. At first the new plan, being unpopular with the vaccinators, who were formerly able to do pretty much as they pleased, was not very successful and the number of operations fell off, but, as the result of warnings, work was undertaken energetically, and the deficiencies were more than made up.

The total number of primary operations performed by the district staff was 624,896, as compared with 592,992 in 1894–95, and the number of re-vaccinations 204,832, against 224,354 in the previous year. The falling off in the number of the latter was due to the effect of orders issued regarding the practice of indiscriminate

re-vaccination. The percentages of success obtained were, in primary cases 93·36, and in re-vaccinations 56·66. There were 61,708 primary operations and 17,597 re-vaccinations performed by the special staff, with success at the rates, respectively, of 90·29 and 51·22 per cent. The cantonment staff performed 4,858 primary operations and 6,015 re-vaccinations, of which 94·77 and 75·58 per cent. were respectfully successful. Besides these, the dispensary establishments performed 2,282 primary operations, and 987 re-vaccinations, of which 93·38 and 51·57 per cent. respectively succeeded. The number of infants successfully vaccinated was 487,217, or 14,910 more than in the previous year, but, notwithstanding this increase, nearly one-half of the number of children born during the year remained unprotected.

Out of the 923,175 operations performed in the province, 657,773, or 71 per cent., were inspected by officers of the Department. Among the Civil Surgeons, some of whom did a great deal of verification, the Civil Surgeon of Ferozepore inspected the enormous number of 19,664 cases. Dr. Roe praises highly the work done by the six divisional inspectors and strongly recommends the appointment of such officers in every division of the province.

Of the large Native States, Patiala heads the list with 98,845 operations, of which 93·45 per cent. of the primary vaccinations, and 40·50 per cent. of the re-vaccinations were successful. In Kurram 2,995 primary operations and 42 re-vaccinations were performed, of which, respectively, 98·63 and 47·62 succeeded.

During the year 93 per cent. of the operations were performed with buffalo-calf lymph, but the difficulty in procuring calves, instead of diminishing, has, it is said, become greater from year to year. Of special importance, therefore, are the experiments in the preservation of lymph, which have been carried on by Surgeon-Major Bamber. White vaseline was the material used, and a lymph-paste made with this substance, was tested under identical conditions, with the same lymph preserved in glycerine and lanoline. The glycerine preparation was found mouldy after being kept a fortnight, and the results obtained with the vaseline paste were better than those obtained either with lanoline paste prepared in Multan or with a specimen of lanoline-paste received from Mysore. Surgeon-Captain James, the Deputy Sanitary Commissioner, who assisted Surgeon-Major Bamber in his later experiments, thus sums up the advantages of vaseline paste :—

"From what I have seen I have come to the conclusion that vaseline lymph has the following advantages over the fresh lymph :—

"(1.) It can be easily carried about in the pocket or sent by post. This does away with the necessity of carrying a child or a buffalo calf as a vaccinifer to the place where the vaccinations are going to be performed.

"(2.) Fresh lymph can only be used on the day the vesicles are ripening, and all lymph not used on that day is wasted, vaseline lymph keeps good for several months and can be used whenever required.

"(3.) Vaseline lymph, being diluted with five times its weight of vaseline, five times as many people can be vaccinated from the same calf as would otherwise supply the fresh lymph.

"(4.) If the vaseline be all manufactured at a central depôt, the vaccinators would be saved all the trouble and time wasted in procuring and vaccinating a buffalo calf at every village or town in which they work. The Special Staff Vaccinator using buffalo calves can usually only vaccinate about 500 people a month. Dr. Bamber's vaccinators using vaseline lymph were able to vaccinate 2,000 people a month. This shows the saving of time which the new lymph ensures.

"I think it superior to lymph stored in capillary tubes, because :—

"(1.) It is more certain in its results, and keeps longer.

"(2.) Much larger quantities can be sent out for immediate use.

"(3.) Capillary tubes are very fragile, and are much more readily broken in transit, specially if sent by post.

"(4.) Pure lymph often coagulates in the tubes, vaseline lymph never does.

"Vaseline lymph seems to be better than lanoline lymph, because—

"(1.) It is of more fluid consistence and less tenacious than lanoline and, therefore, is much easier to work with.

"(2.) It is a mineral substance, and not an animal product as lanoline, and is, therefore, much more acceptable to Hindus.

"(3.) Being clear it is easy to see whether it has properly mixed with vesicles or not. Lanoline is opaque, and it is impossible to determine whether it contains vesicle, &c., or not. This is an important matter if the preparation is left to natives.

"(4.) Moulds, &c., will not grow on vaseline, but they do so on lanoline.

"(5.) So far we have found that vaseline gives better results than lanoline.

"The only disadvantage which I know of against all these advantages is that the new vaccine requires much more careful preparation than the older kinds."

On account of certain rumours to the effect that children who had been recently vaccinated had contracted small-pox, and because one experienced Civil Surgeon had expressed the belief that buffallo-calf lymph was not protective, Dr. James was induced to specially inquire into the prophylactic value of this lymph. His investigations are of peculiar interest, as special inquiry into the degree of prophylactic power of buffalo-calf lymph has not previously been made, and as it is known to die out sooner than that of the lymph propagated through cow-calves. Dr. James could find only one mild case, where a child, who had been vaccinated more than six days previously, had contracted small-pox, and this case was one of bad vaccination, for only two minute marks, said to be vaccination scars, could be detected.

Regarding the efficacy of the buffalo-lymyh Dr. James writes:—

"I visited 23 houses where there was small-pox present and noted what other children were living in the same buildings, and whether or not they had been vaccinated. I found 78 children altogether, of whom 40 had, at some time or other been vaccinated, only two got small-pox, of the remaining 38, who had not been vaccinated, 28 got the disease and only 10 escaped. In one house one child out of six had not been vaccinated. It got the disease and the rest escaped. In another house one out of five children had not been vaccinated and was the only one who contracted the disease. In a third house, that of a Khatri Sikh, none out of five children had been vaccinated. They all got small-pox."

The strength of the Central Provinces establishment was the same as in 1894–95, viz., 27 Native Superintendents, including two in the Feudatory States, and 257 Vaccinators, including 48 in the Feudatory States. The total number of operations performed in 1895–96 was 449,720 against 470,592 in the previous year, the falling off having been in the numbers performed in British territory, for in the Feudatory States there was an increase of 7,569 operations. The percentage of success obtained in primary operations, of which there were 383,556, was 96·37 per cent., and in 66,164 re-vaccinations, 82·11. In addition to these there were 15,755 operations performed by the dispensary establishments against 18,673 in 1894–95. Of these 13,705 were primary operations, and 2,050 re-vaccinations, and success was obtained at the rates of 92·08 and 77·6 per cent. respectively. The decrease in the amount of work done is said to have been due in part to the prevalence of scarcity and distress, and in part to the negligence of the vaccination establishment. The total number of infants protected was 239,865, or 49·3 per cent. of the estimated births of the year. Civil Surgeons inspected 18·58 per cent. and Native Superintendents 51·13 per cent. of the total number of vaccinations, and found, respectively, 87·62 and 91·01 per cent. of operations successful. The lymph used was prepared by Civil Surgeons at each head-quarter station, instead of, as in former years, in one central depôt at Pachmarhi. A supply of calf lymph sent out from England was distributed, but, except in one case, proved inert. In all, 10,199 calves were vaccinated, and the operation was successful in 9,183 cases. With the lymph obtained from them, 283,759 vaccinations were performed, and 264,834 were successful.

The vaccination establishment in Berar consisted of seven Native Superintendents, 45 vaccinators, six apprentices, and seven peons. The total number of operations fell from 137,152 in 1893–94, and 114,639 in 1894–5, to 106,605, the decrease being due to the unhealthiness of the last two seasons, resulting in sickness and mortality among the children and the occasional illness of members of the vaccinating staff. For the same reasons, the number of operations performed by each vaccinator fell from averages of 3,117 and 2,605 in the two preceding years, to 2,423 per man in 1895–96. Of the total number of operations performed, 92,694 were primary and 13,911 re-vaccinations, and the percentages of success were, respectively, 95·9 and 23·4, against 94·7 and 23·1 in 1894–95. The number of infants under one year of age, who were protected, was 67,439, or 58·2 per cent. of the estimated births of the year. Of the total number of operations, 1·8 per cent. were inspected by the Sanitary Commissioner, who found 97·1 per cent. to be successful, and 52·0 by Native Superintendents, who reported 94·7 successful.

The Vaccination Act is now in force in all the municipalities of the province except Karanja, and it has, so far, worked satisfactorily. No prosecutions have been found necessary, the mere serving of the prescribed notice having been sufficient to induce parents who were backward to bring forward their children.

Since 1890 vaccination has been carried on with lymph taken direct from the calf, the season's work, being started with lanoline paste prepared at head-quarters, under the direct supervision of the provincial Sanitary Commissioner.

During 1895–96, the supervising staff in Madras Presidency consisted, as in the previous year, of one Deputy Sanitary Commissioner and 58 Native Inspectors. The

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average number of vaccinators employed rose from 806 in 1894–95 to 842, and the number of operations performed by them, from 1,172,512 to 1,178,970. The increase was not, however, proportionate to the increase in establishment, for the number of operations performed by each man fell from an average of 1,455 in 1894–95 to 1,383. Of the total number of operations performed, 1,103,099 were primary and 75,871 re-vaccinations, and the ratios of success were, respectively, 87 and 80·5 per cent. In addition to these, 19,201 operations, or 7,209 less than last year were performed by the establishment attached to dispensaries. Of these, 17,526 were primary vaccinations, of which 89·0 per cent. were successful, and 1,675 were re-vaccinations, of which 71·0 per cent. succeeded.

In the Presidency as a whole, 22 per cent. of the number of children whose births were registered during the year, were protected, but the percentages varied greatly in the different districts, the extremes having been Madura, where 65·6 were protected, and Malabar where the percentage was only 1·9. In only two of the municipal towns, Kumbakonum (49·2) and Srivilliputtur (18·4), did the percentage of children born during the year and who were successfully vaccinated fall below 50. Of the total number vaccinated, 2·3 per cent. were inspected by Civil Surgeons, and 49·5 by Native Inspectors, and the percentages of cases found to be successful by these two classes of officers, were 90·6 and 89·7 respectively.

Vaccination was carried on with lymph taken direct from the calf, with bovine lymph preserved in tubes and with similar lymph mixed with glycerine and with lanoline. The following statement shows the extent to which these varieties were used and the degree of success obtained with each —

"Vaccinations direct from the calf, 300,518 with 97·8 per cent. success.
" with calf lymph preserved in tubes, 98,703 with 95·1 per cent. success.
" " mixed with glycerine, 641,181 with 89·5 per cent. success.
" " mixed with lanoline, 23,193 with 94·5 per cent. success.

In Coorg the staff acting under the orders of the Civil Surgeon consisted of one Native Inspector and nine vaccinators. The average number of operations performed by each vaccinator rose from 868 in 1894–95, to 1,157 in 1895–96, and the number of vaccinations from 7,815 to 10,411. Of the total, 8,721 were primary operations, and 1,690 re-vaccinations, of which 95·72 and 86·27 per cent respectively, succeeded. Beside these, 602 vaccinations were performed at the dispensaries, of which 61·73 per cent. of the 452 primary operations were successful, and 28·0 of the 150 re-vaccinations. The Civil Surgeon inspected 4·71 per cent. of the operations and the Native Superintendent 32·59; the percentages of success found by these officers were 91·71 and 99·47 respectively.

The percentage of children protected was 17·2 against 9·3 in the previous year.

As usual, all the operations were performed with calf lymph.

In the Bombay Presidency, including certain Native States, the vaccination establishment consisted of five Deputy Sanitary Commissioners, two Superintendents of Vaccination, 45 Inspectors of Sanitation and Vaccination, 16 clerks and 468 vaccinators, besides 511 peons and *karkuns*. The total number of operations performed during the year was 803,850, or 35,621 more than in 1894–95; the average number performed by each vaccinator was 1,854, against 1,779 in 1894–95. Of the total, 727,935 were primary operations, of which 93·25 per cent. were successful, 74,672 re-vaccinations, of which 57·59 per cent. were successful, and 1,243 were repetitions, in cases where the first vaccination had failed. In addition to these, 951 primary operations and 523 re-vaccinations were performed by dispensary establishments. The number of infants successfully vaccinated was 526,324, or about 58 per cent. of the estimated number of births, against 520,074 in the previous year. Of the 669,149 persons vaccinated in British territory, 7·03 per cent of the operations were inspected by Deputy Sanitary Commissioners and 37·67 per cent. by Native Inspectors and Superintendents; the former officers found 95·55 per cent. to be successful and the latter 99·01 per cent.

The use of bovine lymph is being gradually extended. It was exclusively used in the city of Bombay, and it was used in Poona, Sholapur, Ahmednagar and Karachi, and in selected towns and rural tracts in the Western, Central and Southern Registration Districts.

In the Native States of Baroda, Cutch, Kathiawar, Palanpur and Idar, the statistics of which are now compiled separately from those of the Presidency, 213,099 primary operations were successful at the rate of 95·53 per cent., and 5,255 re-vaccinations at the rate of 70·88 per cent. In these States, 162,069 infants were protected, or 4,904 more than in the previous year.

In Lower Burma the vaccination staff consisted of 20 Superintendents of Circles, one Deputy Superintendent (Rangoon), nine Native Superintendents and 123 vaccinators. The number of operations performed rose from 206,092 in 1894–95 to 242,845, but the average number performed by each vaccinator fell from 2,677 in that year to 1,974 in 1895–96. Of the 215,468 primary vaccinations, 91·21 per cent. were successful, and of the 27,377 re-vaccinations 46·01 per cent. succeeded. By establishments attached to dispensaries 1,291 primary vaccinations, of which 92·02 per cent. were successful, and 929 re-vaccinations, of which 37·78 were successful, were performed. There were 41,107 infants protected or about 22 per cent. of the estimated number ef children born during the year.

Civil Surgeons inspected 14·61 per cent. of the cases, and other inspecting officers, 18·13.

In the Upper Province, the staff consisted of 19 Superintendents of circles, one Deputy Superintendent (Mandalay) and an average of 54 vaccinators. The number of operations rose from 114,863 in 1894–95 to 115,703, but the number of operations performed by each vaccinator fell from 2,393 to 2,143. Of the total, 113,778 were primary operations, of which 92·67 per cent. succeeded, and 1,925 were re-vaccinations, of which 66·65 per cent. were successful. Besides these, dispensary establishments performed 4,765 primary operations and 210 re-vaccinations with the rates of success of 91·46 and 77·62 per cent. respectively. There were 30,741 infants protected. Civil Surgeons inspected 33·49 per cent. of the operations, and Native Superintendents and others 12·39 per cent.

For some years past, vaccination has been carried on in the Shan States, but, hitherto progress has been limited. In the Northern States in 1894-95, 941 persons were vaccinated, but the operation succeeded in only 73 per cent. of the cases. In the Southern States there were 3,169 successful cases or about 92 per cent. of the total operations.

The establishment consisted, as in 1894–95, of two Superintendents and 12 vaccinators, but the number of operations rose from 13,356 to 15,978, and the average number performed by each vaccinator from 1,113 to 1,331. The primary operations numbered 15,583, of which 96·24 per cent. proved successful, and the re-vaccinations 395, of which 87·09 per cent. succeeded. The number of infants protected rose from 8,782 in 1894–95 to 10,056 in 1895–96.

Civil Sanitary Works.

In comparing last year's income and expenditure of the municipalities in Bengal with former years, a difference of arrangement must be noted. Formerly the figures dealt with the calendar year; but, as confusion has arisen when comparisons were made with similar information furnished in other reports dealing with municipal administration, in which reference is made to the official year, the local Sanitary Commissioner, on whose report the following account is based, has made use of the figures relating to the official year, ending March 31st.

Excluding Calcutta, there are 146 municipal towns in Bengal. The total income of these, which, in 1893–94, including a balance carried on from the previous year, was Rs. 37,32,074, rose, in 1894–95, including a balance from 1893–94, to Rs. 45,53,651. Of this amount 51·49 per cent. was spent on original or recurring sanitary works, 11·37 per cent. on roads, and the balance on other requirements.

Omitting expenditure which was met from capital, the following amounts were spent on sanitation:—On conservancy Rs. 8,79,988, on water-supply Rs. 7,97,609, and on drainage Rs. 2,73,741. The average proportion of municipal income devoted to original sanitary works was 5·97 per cent., and to sanitary works of an annually recurring nature 35·36 per cent. The towns in which the largest percentages of income were spent on original works were, Jagadispur, 29·25, Cossipore-Chitpur, 21·61, Purulia, 21·20, Baruipur, 21·04, and Jessore, 20·74; on the other hand, in 27 municipalities, there was no expenditure on original works. The town in which the largest percentage of income was expended on ordinary sanitation, was English Bazar, in Malda, 61·65, and the town in which the least was thus spent was Joynagore, 3·48.

During the year the Howrah water-supply works were opened, an additional Rs. 5,13,432 having been spent on them.

A further sum of Rs. 1,00,000 was devoted to the Arrah water-supply. The pumping station is situated at Bahiara, a village on the bank of the Sone, about $5\frac{1}{2}$ miles from Arrah. The Sone water is remarkably pure; it is filtered at the pumping station and forced, through a 13″ main, 28,400 feet long, to an elevated

reservoir in Arrah, whence it gravitates through the distribution pipes. The average quantity of water consumed each day was 150,000 gallons.

The Cossipore-Chitpur water-supply scheme and the drainage schemes for Patna and Muzaffarpur were completed. In other towns, and in the districts, a large number of useful improvements were carried out during the year by municipal authorities, district and local boards, and private individuals. The total amount contributed by private individuals was Rs. 1,88,875, as compared with Rs. 1,51,453 in 1893–94.

Regarding rural sanitation, Dr. Dyson entertains somewhat pessimistic views; the utmost that has been accomplished by the persuasive efforts of the local officers of the Government, has been to convince some village headmen that their village sites should be kept clean and the sources of water-supply uncontaminated; none have been persuaded to take steps to enforce these requirements. Local self-government union committees have, however, been established in selected areas with the view of carrying out measures for the improvement of village sanitation.

The Sanitary Board met seven times; the principal subjects of discussion at these meetings were the following:—

(1.) The improvement of the water-supply of Darjeeling by the construction of settling-tanks.
(2.) A scheme for the supply of drinking water to the town of Gaya.
(3.) The drainage and sewerage of Howrah.
(4.) The chemical and bacteriological examination of water-supplies, and the necessary additional establishment required by the chemical examiner to carry these out.
(5.) The drainage of the town of Krishnagar by the excavation of the Anjona Khal.
(6.) A water-supply scheme for Berhampore.

Preliminary estimates were prepared under the orders of the Board for:—

(1.) A sewerage scheme, including a supply of unfiltered water for flushing purposes for the town of Dacca, to cost Rs. 13,50,000;
(2.) two schemes for the surface drainage of Hooghly, to cost Rs. 54,000 and Rs. 70,000, respectively.

The scheme for the supply of filtered water to Berhampore is at present in abeyance. The Maharani Surnamoyee, C.I., had generously undertaken to defray the cost, estimated at Rs. 2,21,000, of a scheme to bring water from the Bhagirathi. The Board found that the water of the Bhagirathi is of very bad quality, and suggested the sinking of wells in one of the old river-beds, but the Municipal Commissioners refused to accept this suggestion. The difficulty has, however, been overcome, and there is every prospect of the work being commenced within the next three months. Orders have also been received from the Lieutenant-Governor to send up for administrative sanction the scheme for the supply of filtered water to Midnapore.

A detailed estimate for the extension of the Bhagalpur water-works at a cost of Rs. 3,14,000 was prepared. This has been sanctioned by Government, and work will be commenced as soon as possible.

The following projects were considered:—

(1.) An estimate for a small filtered water-supply for Faridpur; this was not approved, as there were grave defects in the filters proposed. The municipality were advised, and agreed, to get the design worked out by the Sanitary Engineer.
(2.) An estimate for the supply of filtered water to Pabna was returned to the municipality for revision.
(3.) An estimate for the installation of Pasteur-Chamber and filters in the Darjeeling water-supply. The Board did not recommend the introduction of these filters, because sufficient trial had not been given to the new settling-tanks, and because sand-filtration continued to be used for all large water-supplies as the most efficient and least expensive method. The views of the Board were, however, not concurred in by Government, as the terms offered by the contractors were so favourable, that, even if the experiment proved a failure, the municipality could not lose, and the estimate has been sanctioned.
(4.) An estimate for improving the drainage of Krishnagar, by the excavation of the Anjona *khal*: the Sanitary Engineer is to work out the details.
(5.) Estimates for the extension of the Bhagalpur waterworks and for the sewering of Dacca, of which mention has already been made.

A large number of miscellaneous references were made to the Board, among them an inquiry by the Chairman of the Serampore Municipality as to the cost of providing

filtered water to that town from the pipes which run through it for the supply of Howrah. The Chairman was informed that it was for the Municipal Commissioners of Howrah to decide whether they could spare any water, and this is unlikely, as the cost of the Howrah scheme was made as low as possible.

In April the Engineer to the Board was permitted to visit the Punjab to examine the system of water-supply from wells used there. Many of the water-supply works in Bengal were inspected by him during the year.

Excluding the towns of Sunamganj, Karimganj, and Maulvi Bazar, in which allowances for sanitary purposes are made by the Local Boards, the aggregate income of the municipalities, stations, unions, and towns in Assam was Rs. 2,60,994, and a sum of Rs. 1,66,675, or 63·86 per cent., was devoted to sanitary purposes. Of this total, however, Rs. 51,500 were spent on roads and bridges, and if this is deducted, 44·13 per cent. was spent on sanitation proper. The details of expenditure were, Rs. 37,859 on water-supply, Rs. 62,506 on conservancy, Rs. 9,227 on drainage, and Rs. 16,304 on markets, village sites, and various sanitary improvements.

Considerable attention was paid to the improvement of the urban water-supplies, and in this respect Gauhati is in advance of the other towns. A comparatively large sum was spent by that municipality in rendering the filtering beds efficient, and, when the arrangements for pumping water from the river are completed, the townspeople will be provided with a sufficient supply of pure water. A new engine has been ordered, and when it arrives, water will be pumped direct from the river into the settling-tanks; the old engines will afterwards be repaired and kept in reserve. In some of the other towns, new masonry wells were constructed, pumps have been provided and reservoirs with taps, so that persons drawing water cannot contaminate the water in the wells. Every effort is made to encourage the smaller towns to improve their water supplies; sanction is refused to the expenditure of large sums of money on the construction of new tanks, and it is hoped that the existing tanks, from which drinking water is taken in the various towns, will soon be fenced in, and the water raised into small reservoirs, from which it can be drawn off.

The small sum spent on drainage is accounted for by the fact that the areas included within municipal limits are so large that effective drainage schemes were considered impossible. All that was done, in most towns, was to clean the open ditches. In Gauhati, however, the drainage of the *bazar* has been taken in hand, a complete scheme has been prepared, and, in accordance with it, masonry side-drains are being laid in the streets. The arrangements for the removal of excreta have been improved in the cases of several towns, and trenching has been more carefully supervised than formerly. The local administration has brought to the notice of the Municipal Committees the necessity for constructing incinerators in those places in which the water-logged state of the soil during the rainy season renders efficient trenching impossible.

The members of the Sanitary Board met twice during the year. They were chiefly occupied with the preparation of rules for the sanitation of villages. A draft Village Sanitation Regulation, adapted to the requirements of Assam, from the North-Western Provinces and Oudh Village Sanitation Act, II. of 1895, was prepared and referred to the local administration for such further action as might be thought necessary.

The income of the 103 municipalities in the North-Western Provinces and Oudh, excluding opening balances, aggregated Rs. 55,06,002. The expenditure on water-supply was Rs. 8,29,523, on conservancy Rs. 8,97,945, on drainage Rs. 3,42,500, and, on markets and slaughter-houses, Rs. 56,432.

Steady progress continued to be made in the sanitation of most of the larger towns, and, although the lack of skilled local supervision is serious, expenditure is gradually being directed on more scientific lines, and less money is spent on well-intentioned but mis-directed efforts than in past times. The villages, however, still remain much as they were. The Village Sanitation Act has been applied to 34 villages and small towns, but until organised action is taken upon it, improvement cannot be expected.

The following notes refer to sanitary works of importance which are in course of development and construction:—

(1.) The Cawnpore waterworks were opened on the 17th March 1894, and, during that year, five gallons of water per head of the population were supplied daily. During 1895, a total of 429,689,695 gallons were supplied, equal to 8·41 gallons per head. Forty-five new house-connexions were made. Analyses of the water supplied were always satisfactory.

(2.) The Lucknow waterworks were opened on the 21st July 1894, and during that year, 65,809,757 gallons of water were pumped into the distribution mains. In 1895, the total quantity of water supplied was 252,701,609 gallons, or 2·6 gallons per head of the population. No new house-connexions were made during the year, and only three applications for the extension of pipe lines in the city were received. The water was invariably reported by the analyst as fit for drinking.

(3.) At Meerut, the foundation stone of the new waterworks was laid by the Lieutenant-Governor early in August, and good progress has been made with the work.

(4.) At Agra, where 6·9 gallons of water per head of the population were supplied from the works in 1894, the average consumption rose to 8 gallons a head, or 441,872,276 gallons. Fifty-eight new house-connexions were made during the year, bringing up the total to 563. Analyses showed the supply of water to be good.

(5.) At Allahabad, 479,469,932 gallons of water were supplied, and the daily consumption rose from 7 to 8 gallons a head. The number of new house-connexions was 262, and the total is now 1,251. The quality of the water was reported to be excellent.

(6.) At Benares, the consumption of water from the supply works rose from 5·9 gallons per head in 1894 to 7·5 gallons, equal to a total of 573,545,691 gallons, in 1895. New house-connexions, to the number of 628, were made, bringing the total to 3,005. The water was invariably reported to be good.

(7.) At Agra, fair progress has been made with portions of the drainage and paving schemes. Plans and estimates for the construction of an intercepting sewer along the river bank, and for draining and paving Nyee Basti, have been submitted to the Sanitary Board.

(8.) At Benares, 76 per cent. of the work on the main sewer had been completed at the end of the year, but the work of construction of the main sewer and of the branches has been delayed by the difficulty experienced in obtaining burnt bricks and pipes up to specification.

(9.) At Cawnpore, the sewerage and drainage works in the *Sadr Bazar* were practically completed on the original estimate.

(10.) At Hardwar, the construction of a trial incinerator of the Garlick type was begun.

There were four meetings of the Sanitary Board at Naini Tal during the hot season. The following subjects were among those discussed:—

(1.) The question of closing all public and private burial grounds within municipal limits. The opinion was recorded, that, so far as possible, burials should not be permitted except in places approved by the Magistrate and the Civil Surgeon as local Health Officer.

(2.) The Government order calling for a report on the best method of maintaining village sanitary records. The Sanitary Commissioner was asked to inquire into procedure adopted in the Central Provinces, and to prepare a note on the subject for the opinion of the Board. This note was discussed at the second meeting, when it was resolved that the secretary should draft a letter in reply to Government.

(3.) The more pressing drainage works required in the Meerut and Agra divisions. It was resolved that the Irrigation Department should prepare a list for submission to Government.

(4.) The complete sanitation of places of pilgrimage. The levying of a small pilgrim tax, such as is already imposed at Hardwar and Benares, was suggested.

(5.) The supply of pure water to the pilgrims at the *Magh Mela* at Allahabad. The Board recognised that it would be impossible to supply all the pilgrims with filtered water from the municipal works, but, at the same time, they were of opinion that the system should be extended to the outlying village of Daraganj. Connexions could be made from the pipe to stand-posts erected for use during the fairs. Suspicious wells to be closed and some trial *piaos* put up.

At the last meeting of the Board, the Government order giving effect to the rules under the Village Sanitation Act was read and recorded.

The income of the 151 municipal towns in the Punjab in 1895 was Rs. 44,04,983, and, as there was a balance of Rs. 11,25,690 from the previous year, the total sum available was Rs. 55,30,673. The amount spent on sanitary works rose from Rs. 11,85,311 in 1894 to Rs. 12,33,037 in 1895, but this includes Rs. 5,43,825 for conservancy establishment, and Rs. 2,77,889 spent on roads and bridges. On water-supplies, including the cleansing and repairing of the wells and tanks, Rs. 1,55,583 were spent, against Rs. 1,75,814 in 1894, and on drainage and sewerage the expenditure was Rs. 1,69,329, as compared with Rs. 2,13,563 in the previous year. The amount realised by the sale of manure and town sweepings, Rs. 1,39,434, shows a considerable increase; in 1892 the sum was Rs. 1,28,804, and this fell in 1893 to Rs. 1,13,733, again rising to Rs. 1,23,644 in 1894.

During the year the water-supply schemes for Umballa City and Delhi were completed; those for the towns of Pind Dadan Khan and Haripur were in progress; while those for Amritsar, Bhiwani, Dera Ghazi Khan, Ludhiana, and Sialkot were still being considered.

At Umballa (population 26,856) the scheme provides for the daily supply of 210,000 gallons to the city, and 37,500 gallons to the civil lines. The water is pumped from 20 deep wells, each 7 feet in diameter, at Handesra on the Tangri river, through an 8-inch main, to a service reservoir in the city. The supply for the civil lines is taken off this main before it enters the city, and is conveyed to two small reservoirs in the civil lines. From the reservoir in the city, which is capable of containing one day's supply, the water is distributed to 50 stand-posts placed in convenient situations.

At Delhi the water is pumped up from wells in the bed of the Jumna to a high-level reservoir, whence it is distributed through iron pipes.

The conserved area of the Kalka water-supply was partially fenced in. Good supplies of water have been brought by means of iron pipes to the villages of Paragpur and Duliana, in the Kangra district; the cost, which exceeded Rs. 6,000, was defrayed by certain philanthropic natives. The scheme for the extension of the Rawalpindi water-supply was completed. At Kohat, a spring, at Surdag, was improved by the construction of a reservoir, and excellent water is obtained from it by the inhabitants of the surrounding villages, and by travellers on the Kohat-Bannu road.

The drainage schemes for Ludhiana, Gujranwala, and Peshawar City (surface drains) were completed, and that for Delhi partially completed; the scheme for Lahore, and the construction of the main outfall sewer at Jhelum, were in progress, and schemes for the towns of Hissar, Hansi, Karnal, Ferozepore, Multan, Gurdaspur, Rawalpindi, Abbottabad, and 13 other towns were under consideration.

Several large drains and cuttings were made in different parts of the Gurdaspur district, in order to improve swamps and reduce the water-logging of the soil. In the districts of Karnal, Hoshiarpur, Jullundur, Ferozepore, Montgomery, Lahore, Sialkot, and Kohat arrangements were made for the distribution of rewards to headmen and others for services in connexion with the improvement of sanitation in their villages.

The members of the Sanitary Board met four times, twice in Lahore and twice in Simla. The following matters engaged their attention :—

(1.) The rules to be observed at the important fairs in the Punjab were discussed, and additions to, and alterations in, the existing rules were recommended to the Local Government for adoption.

(2.) The causes of the unhealthiness of certain tracts in the Umballa district and Kalsia State. It was resolved that the Sanitary Commissioner should undertake an inquiry, in communication with the local officers, reporting progress to the Board from time to time.

(3.) The combined drainage scheme for the city and cantonment of Rawalpindi.

(4.) The insanitary condition of Machiwara, a low-lying badly-drained town in the Ludhiana district. It was resolved that the arrangements made by the canal authorities for the improvement of the sanitary condition of the town were sufficient for the present.

(5.) The excessive fever death-rate in the province, due to water-logging. Proposals made by the provincial Sanitary Commissioner for obtaining the necessary statistical information were approved by the Board.

(6.) The severe outbreak of small-pox in the city of Multan. The Board passed a resolution to the effect that the Vaccination Act should be extended, not only to Multan, but to every municipal town in the province.

There has been no Sanitary Engineer appointed in the province as yet, but, as pointed out by the Chief Engineer of the provincial Public Works Department, specialists are not generally required to carry out the schemes for the small towns, and, when a scheme has to be carried out for a large town, there are always engineers, who have given much time and attention to sanitary works, available from the provincial service. As soon as one project is completed an officer of special experience and a staff more or less completely trained become available to commence another.

The income of the 19 municipal towns in the Central Provinces was Rs. 18,03,356, and, excluding sums spent on medical relief, vaccination, and miscellaneous objects, aggregating Rs. 75,231, a sum of Rs. 2,98,596 was spent on sanitary works, including Rs. 1,95,861 on conservancy, Rs. 50,449 on water-supply, and Rs. 32,586 on buildings. The chief works carried on during the year were the following :—

The extension of the Jubbulpore waterworks. This was begun in September 1894, and Rs. 2,09,167 of the Rs. 2,48,283, which the extension was estimated to cost, had been spent by the end of 1895. The following portions of the work have been finished: A straining tower at the reservoir, with a syphon over the dam from the reservoir into the tower. A 12-inch main has been laid from this tower to Jubbulpore. Distribution pipes varying from 3 inches to 12 inches in diameter have been laid in the city, civil station, and contonments, about 16 miles of pipes in all, and standards have been erected in the town and civil station.

At Wardha, the boring for water, referred to in last year's report, was continued until a depth of 90 feet was reached, when the scheme was abandoned. A complete estimate for the supply of the town with water, pumped from the river at Pownar, at a total cost of Rs. 2,07,057, was submitted in November 1895, and the foundation-stone of the work was laid by the Chief Commissioner in December.

At Bhandara investigations and experiments regarding a possible supply of water by filtration from the sandy bed of the river Wainganga, were commenced and are in progress.

At Harda two experimental wells were sunk and a supplementary estimate was sanctioned.

At Khandwa the water-supply works were in progress, and Rs. 95,708 were spent on them during the year.

At Hoshangabad a survey of the town was completed in connexion with a water-supply scheme.

Meetings of the Sanitary Board were held once in each division during the year, and the first Annual General Meeting took place in Nagpur in August.

At this meeting statements were presented to show :—

(1.) The works completed since the institution of the Sanitary Board and their cost, which was Rs. 1,92,640.

(2.) The works under construction, with estimates for works to be carried out in the year 1895–6, amounting to Rs. 22,206 from district funds and Rs. 29,222 from funds locally obtained.

(3.) The proposals and estimates for sanitary undertakings for 1896–7, to cost from district funds Rs. 26,312 and from other funds Rs. 27,842.

As regards the expenditure in 1895, the amount fell far short of the estimate on account of scarcity of funds. The expenditure incurred, Rs. 33,535, was mainly on account of the digging of new wells, repairs to old ones, and clearing of village sites.

The total estimated income of the 11 municipalities in Berar in 1895 was Rs. 2,41,338, and no less than Rs. 1,02,504 were spent on sanitary works, including Rs. 66,074 on conservancy, Rs. 25,944 on water-supply, and Rs. 10,486 on drainage.

No new work of importance was undertaken during 1895, but the year having been one of drought, the existing arrangements for the water-supply of the towns were tested at Akola, where it was feared that the Kapsi waterworks, not being quite complete, would fail after the prolonged absence of rain ; it was found, however, that there was sufficient water available to keep up a small supply for the city. At Amraoti the water-supply failed, and the Kalapani tank, which, it was believed, would give a good supply of water to the city, was empty, and wells had to be sunk in its bed. At Khamgaon the tank, which has hitherto been believed sufficiently large and good, was not filled, and the water-supply of the city was much reduced.

The drainage scheme of Amraoti has been remodelled on a scale within the means of the municipality ; plans and estimates are under consideration, but is has been decided to carry out the work gradually as funds permit. At Akola, the municipality, although funds are scarce on account of recent expenditure on the water-supply, are

doing all that they can to have the town drained. At Shegaon excellent drainage work is carried out steadily and persistently. At Akot and Ellichpur considerable proportions of the funds were expended in this direction.

The District Boards set apart Rs. 94,715 for sanitary works, and spent during the year, Rs. 32,979 on water-supply, Rs. 42,323 on conservancy, and Rs. 10,449 on drainage, making up 90·5 per cent. of the total sum allotted.

The District Sanitary Board met six times, once at each head-quarter station, and examined the result of recommendations made by the provincial Sanitary Commissioner. The recommendations had been carried out in a large number of instances and only want funds it is said impedes further progress. The question of a sanitary law for the improvement of village sanitation is being considered.

In 1895 there were, excluding Madras, 56 municipal towns in the Presidency, and the estimated income of these, in 1895–96, was Rs. 28,86,470, of which Rs. 16,23,540 were allotted for sanitary purposes. The sums actually spent in the nine months ending with December 1895, were Rs. 3,69,982 on conservancy, Rs. 1,58,139 on the improvement of town and village sites, Rs. 1,40,359 on the improvement of water-supplies, and Rs. 56,770 on other sanitary objects, making a total of Rs. 7,25,250, or only 44·6 per cent. of the allotment, leaving a sum of Rs. 8,98,290 to be spent in the first quarter of 1896. The municipal income of the city of Madras was estimated to be Rs. 16,83,360, of which a sum of Rs. 8,18,996, or 48·6 per cent of the total, was set aside for expenditure of sanitation. Of this sum, 36·0 per cent. had been spent by the end of 1895, including Rs. 1,90,816 on conservancy, Rs. 59,640 on the improvement of sites, and Rx. 17,540 on improvement of water-supplies.

While only 19·4 per cent. of the sum allotted by Municipal Committees for expenditure on water-supplies was spent during the first three-quarters of the financial year, 70·6 per cent. of the conservancy allotment was spent. The Sanitary Commissioner points out that it is far more difficult to get a municipality to spend money on improving the supply of water than in the disposal of sewage. The sewage is a nuisance, which must be got rid of in some way, whereas it is difficult to persuade a council that the water, which has been in daily use for many years, requires to be improved upon. Although it seems that disposal of night-soil and rubbish, after collection, is not carried out properly, except in a very few towns, it is hoped that the employment of the certificated sanitary inspectors, who are now available, will lead to improvement in this respect; meanwhile, the advantages of sewage farming are being impressed on the councils by the Sanitary Commissioner. At Madras, certain of the more glaring defects in connection with sewage farming operations carried on there have been remedied, but it appears that much remains to be done. At Tanjore the improvements to be effected should result in the sewage farm there becoming a model. At Erode sewage farming on a small scale was begun during the year. At Vizagapatam a sum of money has been set aside to start a farm, while at Cuddapah and Vizianagram proposals are receiving consideration. In the last-named town, it has been the custom to discharge much of the sewage untreated into a body of water, known as the Peddadcheruvu, resulting in a serious nuisance to the townsfolk; by the advice of the Sanitary Commissioner, a temporary sewage filter was constructed, which is acting efficiently. At Vizagapatam, where much of the sewage was sent direct into a back-water, a similar under-drained sewage filter was constructed; about 7,200 gallons of sewage are treated daily, and the filtrate is clear and looks like pure water.

The following works were completed and opened for the use of the public during the year:—

(1.) The Adoni water-works. The town is supplied by gravitation from filtered water reservoirs, but when only two of the three filter beds, 50′ × 40′ each, are being used, they must permit of filtration of the 230,000 gallons of water required, a little too quickly to accord with recently promulgated opinion, and the filtered water reservoirs are inefficiently protected from dust; these defects, however, which have been pointed out by the Sanitary Commissioner, can be easily remedied. Much of the cachment area has been bought up, and the Municipal Committee have been advised to acquire the remainder.

(2.) The Tanjore water works. Water is pumped up from an infiltration bed in the river Venar. It has been the custom to stop pumping on Sunday, the result being on that day the people make use of the old contaminated sources of water-supply, and the pipes of the new supply are liable to contamination by aspiration. These defects have been indicated, and it is intended to make a service reservoir to be filled by the surplus water pumped up; this will keep the pipes full and prevent aspiration.

The following were among the subjects which engaged the attention of the members of the Sanitary Board during the year:—

(1.) The water from Marlimund reservoir at Ootacamund having been shown by analysis to be bad, and samples taken from the bottom of the reservoir having been found to consist of masses of vegetable matter, it was advised that a new storage reservoir should be built, and that tracts of jungle should be excluded from the catchment area. As the matter presented considerable engineering difficulties, the Board advised the appointment of an engineer to prepare a a suitable scheme.

(2.) For Salem, where the supply of water is not only impure, but scanty, several schemes were proposed, and projects are still being considered.

(3.) For Cuddapah, the filtration of the water-supply, a pipe sewerage scheme, and a complete system of subsoil drainage were recommended by the Sanitary Commissioner and agreed to by the Board.

(4.) For Coonoor, it was recommended that investigation should be made into alternative proposed sources of water-supply.

(5.) For Bezwada, a water-supply scheme is still under discussion.

(6.) For Gudiyattum, a cheap project for water-supply from infiltration galleries in the sub-stream of the river was discussed.

(7.) For Calicut, alternative projects for a water supply were considered.

The estimated income of the district boards, for 1895–96, was Rs. 75,47,420, and of this, Rs. 6,96,428 were allotted for sanitary works, but, during 1895, only Rs. 3,57,775 were spent under the following principal heads:—On water-supplies, Rs. 54,940, little more than one-third of the sum allotted; on conservancy Rs. 2,36,576 or 70 per cent. of the allotment, and on improvement of sites Rs. 26,466, or 43 per cent. of the allotment. Although there has been an increase of Rs. 41,093 in the sum devoted to sanitary purposes, as compared with 1894, considerable differences in the amounts allotted by the various boards exist. The Boards of Tinnevelly and Godaveri, for instance, allotted 15·3 per cent. of their incomes, while the Boards of South Canara, Malabar and Nilgiris allotted only 3·5, 2·6, and 1·9 per cent. respectively; moreover, there is a great variation in the proportions of the allotment expended, although in this respect, also, Dr. King notes an increase. The Sanitary Commissioner, moreover, testifies to improvements in arrangements made for fairs and festivals in the districts.

In Coorg the amount spent on sanitary works was Rs. 12,423, of which the water supply works at Mercara absorbed Rs. 6,487. These works were not completed before the monsoon, so that the reservoirs could not be completely filled. So far, however, the people appreciate the water supply, and have subscribed Rs. 2,300 for the extension of the pipes along the Fraserpet Road, while the success of the scheme has caused other small towns to clamour for similar supplies. In one of these, Virajendrapet, Rs. 14,550 towards a scheme have already been subscribed by the inhabitants, and surveys were being made.

The Sanitary Board met once, in July, and the following matters engaged the attention of the members:—

(1.) The proposal for a water-supply scheme, made by the municipality of Virajendrapet; plans and estimates are to be submitted by the Executive Engineer.

(2.) A proposal to provide a supply of pure water to the small village of Boikeri, towards which the inhabitants had promised to subscribe Rs. 600.

(3.) A proposal to build shelters on the ghât roads for the coolies who travel over them; it was resolved to build five shelters, and to entertain an establishment to take charge of them.

(4.) A proposal made by the Civil Surgeon to introduce the sale of quinine at the Post Offices, was agreed to, and the Commissioner was requested to address the Local Government on the subject.

(5.) Schemes for the building of a lying-in hospital, for the construction of side drains in the main street of Mercara, and for the building of a lying-in ward and nurses' quarters at Virajendrapet, were brought forward for consideration and sanction.

(6.) The Civil Surgeon enquired as to the fate of the rules for the preservation of the health of the coolies employed on the coffee plantations, sent by the Chief Commissioner for revision and reconsideration of the Board. He was informed that the rules had been sent to the Coorg Planters' Association for their opinion, and that a reply had been received to the effect that no

opinion could be passed on these rules until the members of the Association had been given an opportunity to consider certain subsidiary rules which had drawn up by the Local Government; this reply of the Association had been submitted to the Local Government.

The total income of 168 municipalities in the Presidency of Bombay in 1894–5 was Rs. 47,49,303, and of this a sum of Rs. 21,50,827, or 45·28 per cent. of the whole, was set aside for expenditure on sanitary works. The sums spent, however, fell short of the allotments under all heads of expenditure, and only Rs. 18,21,963, or 84·71 per cent. of the allotment was used. Of the total, Rs. 8,69,219 were spent on conservancy, Rs. 4,96,543 on improvement of water supplies, and Rs. 2,15,979 on improvement of town sites. The income of the District Local Boards was Rs. 38,06,842, and of this Rs. 7,89,206 was assigned to sanitary works, but only Rs. 5,16,698 were actually spent, chiefly on improvement of water supplies, including the construction, cleansing, and repairing of tanks and wells, to which a sum of Rs. 4,76,202 was devoted.

The Bombay Village Sanitation Act of 1889, which provides for the contribution by the Local Board and the Provincial Fund of two-sixths and one-sixth respectively of the total cost of such schemes as provide for the improvement of village water supplies, &c., on the condition that certain of the villagers are competent and willing to assist in the supervision of their working, was introduced into 163 villages up to the end of 1825.

No new sanitary work of importance appears to have been undertaken during the year. At Surat only preliminary work on the water-works was carried on pending a decision of the High Court regarding a new house tax. At Ahmednagar, the plans and estimates for the first section of the water-supply works have been completed under the direction of the Sanitary Engineer; application for a loan has been made to Government, and it is hoped that the work will be completed during the current year. At Nasik, where the water supply is scanty and drainage very defective, the questions of a water supply and drainage are being considered. At Sukkur rapid progress on the water-supply works was made, and a drainage project is being prepared. At Ahmedabad, the sewage farm has been much improved, but more land is required, and what there is should be suitably levelled and laid out for broad irrigation.

The number of meetings of the Sanitary Board is not stated. Advice was given by the Board regarding a large number of projects, including the improvement of the water supplies at Dakor, Alandi, and Kirki; a scheme for the supply of Parel; the experimental drainage scheme for Ahmedabad; the drainage and sewerage of Yeola; a drainage project for Dhulia; and the question of house connections with the sewerage system at Colaba.

The grand total of the incomes of the towns and districts of Upper and Lower Burma in 1895 was Rs. 54,69,359; of this sum Rs. 19,87,857 were spent on the work of sanitation, including Rs. 3,37,133 on water supplies, Rs. 3,73,052 on drainage, and Rs. 7,40,722 on conservancy. No new work of any magnitude is reported to have been begun.

In Rangoon the Shone and Ault sewerage system is being gradually extended; during the year 401 house-connections were made, and 1,015 latrines were constructed. The reclamation of the east end of the town is being pushed on steadily.

In Moulmein the survey of the town has been completed, and levels of the drains obtained. The water-supply scheme is not yet begun. Alternative projects are under consideration; the one provides for the pumping of river water to a reservoir on a hill behind the town, whence, after filtration, it would be distributed by gravitation; the other provides for a reservoir in the Toungwin hills, about seven miles away from the town. The latter project appears to be beyond the means at the disposal of the municipality.

At Prome the filter gallery connected with the pumping station which has been abandoned for the past nine years, was put into working order and has been in use since May 1895. About 25,000 of the 30,000 inhabitants of the town are supplied with water from the hydrants.

The Sanitary Board's work continued to be restricted to the provision of suitable sanitary maps of the larger towns in Lower Burma.

General Remarks.

Revision of the Cholera Rules.—In concluding the report of their investigations into the outbreak of cholera in the Lucknow Garrison in July and August 1894, the Special Committee recommended that the practical certainty of the truth of microbic

infection should be used as the basis of the next revision of the rules regarding the measures to be adopted on the outbreak of cholera. Sanction was given by Government to the assembly of a committee composed of the Quarter-master General in India, as President, the Principal Medical Officer in India and the Sanitary Commissioner with the Government of India, as members, with Mr. Hankin, the Chemical Examiner and Bacteriologist, North-Western Provinces and Oudh, as associated member to consider the question.

A copy of the revised rules, the adoption of which was sanctioned by the Government of India on the 10th of September 1896, is printed as an appendix.†

Anti-Cholera Inoculations.—The anti-cholera inoculations, which were begun by M. Haffkine in 1893, have been carried out in Colcutta continuously, in Assam, and in various parts of the country under the general direction of M. Haffkine himself, to whom every assistance has been given by the Government of India and the local authorities concerned. As M. Haffkine has been busily engaged in Bombay on an inquiry into the nature of bubonic plague, he has been unable to furnish a complete statement of the results of the inoculations. So far as the tabulated numerical results received go, however, they are certainly very encouraging.

The Red Sea Pilgrim Traffic.—The following short summary of the facts concerning the Red Sea Pilgrim traffic and the outbreak of cholera at Camaran, is taken from the report of the Health Officer of the Port of Bombay, from the report of Dr. Vaume, Chief of the Camaran Mission, and from the report of Her Majesty's Consul at Hodeida and Camaran.

The number of pilgrims who left Bombay for the Haj was the second highest on record. The 26 veseels which left the port afforded accommodation, on the scale laid down by the Native Passenger Ships Act, for 17,056 adults, and 17,102 pilgrims, including 751 children under 12, and 223 infants under one year of age, were embarked. The vessels, which were of the usual class employed on the trade, were, on the whole, well ventilated, and provided for each pilgrim 9 square feet in the 'tween-decks and 6 square feet on the upper-deck. Only one vessel, the Turkish steamer "Abdul Kadir," required considerable alterations and repairs to enable her to carry a fairly large number of pilgrims under the provisions of the Indian rules. The luggage nuisance was less prominent than usual.

During the outward voyages the health of the pilgrims was fairly good, as there were only 484 admissions to hospital, and 61 deaths. The chief causes of admission were fevers, diarrhœa, dysentery, and injuries. As usual, the majority were admitted for bowel complaints during the voyage from Camaran to Jeddah. The most common causes of death at sea were, fevers (18), old age and debility (9), general debilty (6), dysentery (6), and phthisis (4); there was one death due to diarrhœa. During quarantine at Camaran, 147* pilgrims died, including 72*, whose deaths were attributed to cholera. From this it will be seen that in proportion to the time spent there, including special detentions, and not counting deaths from cholera, the mortality at Camaran was far higher than on board the ships, the relation being about 3 to 2.

On the return voyage, 17 vessels, with space for 12,874 adults, carried 10,472 persons to Bombay. The number of admissions to hospital on the voyage was 345, and there were 88 deaths, due chiefly to general debility, dysentery, and old age. The difference in the numbers who leave for, and return from, Arabia by sea is generally about 33 per cent.; in 1895 the percentage of "missing" was only 28.

Camaran.—The Haj of 1895 took place on the 4th of June, and the lazaret at Camaran was opened on the 20th of the preceding December. The earliest pilgrim steamer was the "Java," which arrived on the 29th January from the Dutch Indies. The first Indian pilgrim steamer was the "Mohammadi," which reached Camaran from Bombay on the 1st of February. Subsequently 36 vessels, including 9 dhows, brought pilgrims to Camaran to undergo quarantine. The total number of pilgrims landed was 24,062, including 10,010 Indians and 880 Afghans. The quarantine imposed was from 24 to 48 hours in the case of pilgrims from Persia and Hadramaut direct, five days for pilgrims from Java and the Straits (until cholera broke out at Camaran), and 10 days for pilgrims from Indian ports. The weather was exceedingly unhealthy throughout the season, with cold mornings and very hot days, and the mortality among the pilgrims detained in the lazaret was 6·9 per 1,000, as compared with 2·23 in 1894.

* In the British Consul's report the figures are 162 and 67.

† Not reprinted.

Cholera at Camaran.—The evil fortune which attended the passengers of the "Hosseinee," who were obliged to return to India without having accomplished the Haj, has drawn a larger share of well-merited attention to the condition of affairs at Camaran than this has hitherto received.

Cholera developed among the pilgrims of three vessels from Bombay during their periods of quarantine, and the circumstances were very remarkable.

During 1895 the town and port of Bombay were unusually free from cholera. Only 90 deaths were registered during the year, a smaller number than in any of the previous eight years except in 1886, when only 19 deaths were recorded. During the first four months of the year there were only six deaths, as low a number as has ever been recorded; three occurred in January, one in March, and two in April. The three steamers, the "Mohammadi," "Jubeda," and "Hosseinee," are among the very best pilgrim liners in the trade, and their sanitary condition was excellent when they were examined prior to the embarkation of the pilgrims. On the voyage to Camaran they touched at only one intermediate port, namely, Aden, where there was no cholera.

The "Mohammadi" left Bombay on the 6th March and arrived at Camaran on the 16th. Three deaths occurred on the voyage, ascribed, respectively, to debility (8th March), pneumonia (8th), and pulmonary consumption (15th). There were 818* pilgrims on board, who were landed and placed in camp under the care of Dr. Halim Bey. On the 23rd March, seven days after arrival and 17 after leaving Bombay, a Malabari died, and two others were seized with diarrhœa. Dr. Vaume writes:—

"These were serious cases, but not yet typical it is true, yet they were sufficiently pronounced for the purpose of observation."

Cholera was declared to be present on the 24th, and 15 days' extra quarantine was imposed. Cases of cholera continued to occur, with resulting imposition of fresh periods of quarantine, until the 7th of April. The pilgrims were re-embarked, and left on the 23rd April for Jeddah, where they were detained for another five days before they were allowed to leave for Mecca. Regarding their stay at Camaran, Dr. Vaume writes:—

"These pilgrims remained in the lazaret 39 days; cholera had raged during 17 days, attacking 31 persons, 27 of whom were pilgrims; 29 died, of whom 25 were pilgrims; the other victims were a Danakil working as night-man, two soldier guards, and one soldier in charge of the cordon. Besides these, 28 pilgrims died of various diseases, and two soldier guards of dysentery. From this resumé I observe two things, tardy appearance of the disease, and its localization at the outset among the Malabaris, who came from Calicut."

The S.S. "Jubeda" left Bombay on the 16th March, and reached Camaran on the 25th. There were 1,006† pilgrims on board. Three deaths occurred on the voyage, two of old age on the 22nd and 24th March, respectively, and one of pulmonary phthisis on the 23rd. The landing of the pilgrims was deferred until the 26th March, when they were encamped and placed under the care of Dr. Boumbouras. The health of the prisoners during the first few days in camp was excellent, but during the night of 29–30th March four Afghans were "almost simultaneously" seized with cholera. Cases occurred until the 21st April; 57 individuals were attacked, and 48 died. "The course of the epidemic," writes Dr. Vaume, "left the impression that there was some "general cause operating continuously, but not showing itself, except at measured "intervals according to the degree of individual resistance to the disease." The "Jubeda" left Camaran on the 10th of May for Jeddah, where the pilgrims do not seem to have been further detained.

The S.S. "Hosseinee" left Bombay on the 10th and arrived at Camaran on the 18th April. During the voyage no death occurred, and no pilgrim required medical treatment. The number of pilgrims is stated on the ship's bill to have been 697, but the number landed is stated by the Consular Agent to have been 706. These pilgrims were placed in camp under the care of Dr. Moschidis. Cholera appeared in the camp on the 24th April, the 6th day after arrival and the 14th after departure from Bombay. The disease was confined, until the 17th May, to Malabaris. Cases continued until the 27th May, when it was evident that, if further quarantine were imposed, the pilgrims must be too late for the Haj. Finally, after much telegraphing, the pilgrims resolved to return to India, and the "Hosseinee" left for Bombay on the 1st of June. Dr. Vaume notes that "nearly all the cases on the steamer "Hosseinee"

* According to the Consul's report; 781 according to the ship's books.
† 1,046 according to British Consul, and 1,041 according to Dr. Vaume.

" had their origin in the same town as the earlier cases on the steamer " Mohammadi," " viz., Calicut on the Malabar coast," and he concludes his account of the " Hosseinee's " detention as follows :—

" To sum up, cholera raged from the 18th April (N.S.) to the 25th of May; it attacked 21 persons, 16 of whom died, viz., 3 Bengalis (1 was cured), 17 Malabaris out of 119 (4 were cured), and a native guard. This epidemic is remarkable alike for its persistency among the Malabaris, the somewhat long period that elapsed between the cases as well as for the acuteness of the attacks. It has also been interesting in that it has furnished proof as to the origin of the disease. Moreover, in the Mervani camp, in which the pilgrims of the " Hosseinee " were lodged, there has never been cholera; it would be childish on the part even of the bitterest enemies of our lazaret to contend that Camaran gives cholera in certain years, especially to inhabitants of Calicut and its neighbourhood. The utmost subtlety would fail to prove that the Indians from Malabar got the contagion at Camaran. I am well aware that the legend is wide spread in India, and I have read several diatribes in the Bombay papers, and can understand how it was that the idea enters into the Indian pilgrim's head to exclaim the second day after being lodged in our lazaret, 'I arrived here quite well, but your water has given me diarrhœa.' A little more imagination, and it would be said that Camaran is situated on the Hooghly."

Dr. Vaume is of opinion that the Malabar pilgrims brought cholera from Calicut on the Malabar coast. The population of the district of Malabar is considerably more than two-and-a-half millions. The number of deaths that occurred from cholera in 1894 was 1,145, of which 135 were registered in Calicut. Most of the deaths occurred in the earlier part of the year. In 1895 only 429 cholera deaths were recorded in the district, and the cholera mortality was ·2 per 1,000 of the population, as compared with 1·5, the mean of the five years 1890–94. In Calicut town there was only one death from cholera registered during the year, on the 3rd of February, and the rural circuit of Calicut was entirely free from cholera throughout the year. It is strange, then, that Malabaris should bring cholera from a place in which it was practically non-existent.

This is how Mr. Vaume explains the absence of the disease during the voyage :—

" The question, however, is not an easy one; the following is the position: Three pilgrim ships arrive at Camaran from Bombay after a voyage of 9 or 10 days. The captain and the doctor say that nothing suspicious has occurred during the voyage; the ship's papers bear out their statement, and, on the whole, the thing appears probable. Between the 5th and 7th day after the pilgrims have landed cholera appears among them. An unreflecting person would say, therefore, 17 days' incubation. Let us pass over such a crude manner of reasoning, and look more closely into the matter, and in a manner which is apparently more probable.

" Dr. Koch assures us that he has found in great numbers and alive in the waters of the marshes in the vicinity of Bombay certain vibrios which have since spread. This vibrio is the cholera germ. Indians who frequently use those waters absorb them in masses without getting cholera. Owing to this circumstance it is said that the vibrio is harmless; it will be agreed, however, that there may be in the human system certain antidotes entirely unknown elsewhere which it is supposed do exist there; in fact as the vibrio does not find either in the stomach or the intestines the requisite conditions, investigation has only been directed in recent times to ascertaining what are the requisite conditions it vegetates in this domicile without acquiring that virulence which alone discloses its existence and attracts our attention. It exists then in a latent state it will be said. So be it; but the interesting point for us is to discover and determine the circumstances which put an end to this latent state and convert the common inmate of the gastro-intestinal canal into a terrible poison which used formerly to cause those deadly epidemics during which the existence of a great nation appeared at time to be stopped in its course. Metchnikoff appears to have clearly pointed out the path to follow in these investigations. He has shown that the nature of the gastro-intestinal coating modifies the vitality of the comma bacillus in such a way as to make the most harmless virulent and the most virulent harmless. His experiments, carried out with that precision and ingenuity of which that unique mind has given so many proofs, have not yet been disproved, and without accepting them as definite and as absolutely correct, they may at least be taken as a basis, for we should be certain of treading on almost firm ground. I can, therefore, well imagine that Malabaris who left their country where cholera had raged with great severity towards the end of 1894, carried cholera germs alive in a latent condition in the intestines, that these germs under influences unknown to me became virulent, and, lastly, that cholera appeared among them at Camaran. But again, has it been quite proved that these influences exist at Camaran? Finding that the water in the cisterns had become after a certain time as it were thick to the touch and weedy, I prevented this water from being given to the pilgrims of the " Hosseinee," and I, daily, had the water which was taken from the wells supplied to them. The result was the same. How glad we should have been to have had a laboratory this year, and a competent assistant. I do not say that I would have been able to lay before you any conclusion, but I should not at least have been reduced after so much writing to leave matters in such doubt.

" Do not think that I am satisfied with this hypothetical explanation. Another corollary, however, connected with it, which throws light on obscure points, comes to my mind. It is still less definite and difficult to formulate; I will, however, endeavour to explain it. Let it be granted according to the theory enunciated at the Buda-Pesth Congress of 1894, that two elements are

required to bring about cholera, one which is known, viz., the comma bacillus, the other still unknown, which is due to surrounding circumstances, the nature of which we do not know.

"The ancients used to call it the epidemic genius, and we endeavour to discover it by limiting more and more the known quantities of the problem. The great role indeed of modern science is to explain in a scientific manner the vague and striking terms of the ancient observer. I imagine that those conditions can be found to exist, why and how I cannot say, at Camaran and in the Hedjaz at the same time. And as the journey of the Indians who go direct to the Hedjaz is performed under infinitely better conditions than the great masses of the pilgrims enjoy who come to Camaran, I do not see why the appearance of disease among them should not be a little later than at Camaran. Although I admit that this way of looking at the question possesses no value, yet I lay it before you. In this way the almost simultaneous appearance of cholera at Camaran and in the Hedjaz might be explained without connecting one with the other. It might, perhaps, also be thought that infection is carried by the wearing apparel, and in that case it might be argued that disinfection was not properly done. I have often explained how it is done, and I need not refer to the matter here. However, to make disinfection still more efficacious to render it almost ideally perfect, we want at least another moveable stove for work, especially in the camps that have contagion. We also require a larger staff. It remains for me to address you on these points, but I must remind you, in the first place, that cholera showed itself among the staff, and this is the strongest reason in favour of the necessity of shutting off the divisions from each other in a proper manner."

This explanation is a little difficult to follow, and it certainly reads like an admission that the potent cause of the cholera epidemics exists in Camaran and the Hejaz, which, it must be admitted, is the simplest way to explain the facts. The probability of prolonged latency is negatived by all experience of cholera, but if such latency could exist, quarantine is evidently a vain precaution! It appears, however, that Doctor Vaume is sceptical as to the absence of cholera on the pilgrim ships; and the fact that the numbers of pilgrims landed generally differ from the numbers declared to have been embarked, lends justice to his remark, after comparing the figures. "A portion, "therefore, of the effective strength may disappear without our being in a position to "discover."

The urgent wants of Camaran are arrangements for a supply of good drinking water and proper accommodation for the pilgrims. In its present state this quarantine station is evidently not only useless for the purpose for which it is intended, but may be a source of danger to the Hejaz.

Researches by the Special Assistant.—Most of the work which was conducted in the Biological Laboratory attached to the office of the Sanitary Commissioner with the Government of India during the past year, was devoted, 1st, to a series of experiments dealing with the question of the action of snake-venoms as primary hæmic or primary nervine toxins, and, 2nd, to experiments in regard to natural and artificial immunity to the action of snake-venoms, and to the protective and curative action of antivenenes.

The results of the first series of experiments will form the subject of a paper in the forthcoming number of "Scientific Memoirs, &c.," and appear conclusively to indicate that cobra-venom, at all events, has a very marked action on the blood of susceptible animals, leading to very rapid solution of erythrocytes and more gradual reduction in the respiratory property of the hæmoglobin, and that variations in susceptibility to the toxic action of the venom are accompanied by corresponding variations in the degree to which the latter is capable of giving rise to hæmic changes.

The second series of experiments has already been dealt with in a special report, and the data furnished by it appear to justify the following conclusions:—

(1.) The serum of the blood of animals, which have been artificially immunised to the action of lethal doses of snake-venoms by means of habitual and cumulative treatment with the latter, unequivocally possesses antidotal properties, and hence may fairly be denominated antivenene.

(2.) The term antivenene is, however, of generic, not specific value, for the antidotal material contained in the blood of animals which have been artificially immunised against colubrine venom is inert against viperine venom and *vice versâ*.

(3.) The amount of active antidotal material in the blood of artificially-immunised animals would appear to bear a definite and direct relation to the amount of venom against which immunity has been established, the actual quantity of antidote present in the system in any case being apparently little in excess of that requisite to equilibrate the toxic action of the amount of venom, under the influence of which it has been elaborated.

(4.) In consequence of this, treatment with crude antivenene is only adapted to secure recovery in cases where minimal or, at utmost, slightly supra-minimal lethal doses of venom are opposed by relatively large doses of the serum of highly-immunised animals.

In order to secure recovery after the access of any given dose of venom to the system, the quantity of antivenene which must be employed will necessarily vary with the degree of immunity which has been established in the animal from which it has been derived. In cases where the degree of immunity has been very high, relatively limited quantities of antivenene may be capable of conflicting successfully with small doses of venom; but, as in order to conflict successfully with any given dose, an amount of antivenene equivalent to the entire, or almost entire, antivenene content of the blood of an animal which has been immunised against a like dose is necessary, so in dealing with large doses of venom the amount of the remedy requisite to secure recovery must almost inevitably become prohibitive, and treatment with crude antivenene would probably be little better than treatment by transfusion of blood.

(5.) Treatment with crude antivenene, more especially in combination with other remedial measures, such as ligature and free incision and injections of solution of bleaching powder or gold chloride at and around the site of injury, may, therefore, be of some practical value in dealing with cases in which minimal lethal or slightly supra-minimal lethal doses of venom are in question, but, unless the really active constituent can be separated from the rest of the serum, its curative value must remain strictly limited.

(6.) The superiority of antivenene over other remedies in dealing with small doses of venom lies in the fact that its action is not a purely local one, but one which continues to be exerted subsequent to absorption into the circulation, so that it is capable of dealing with venom which has been already absorbed, and may therefore be an important aid to means which only act locally in reducing small lethal doses of venom to sub-lethal ones.

(7.) While the serum of the blood of animals which have been artificially immunised possess antidotal properties in relation to the venom in connection with the action of which the immunity has originated, this is not the case with the serum of the blood of the snakes which produce the venom, and consequently the natural immunity of venemous snakes to the action of their own venom cannot be essentially dependent on any process of auto-inoculation, or, in other words, on the constant and normal presence in their blood of any material of the nature of the antivenene elaborated in the bodies of artificially immunised animals.

(8.) The protective effect attending the introduction of antivenene into the system is a very transitory one, whilst that attending the habitual introduction of venom is persistent over prolonged periods, and therefore, whilst in the latter case the protection would appear to be dependent on persistent, reactive, systemic manufacture of an antidote, in the former it is seemingly merely dependent on the introduction of a ready-made antidote, which, because it is a blood derivative, is capable of remaining for some time unaltered within the system.

(9.) The ingestion of large quantities of cobra-venom, either habitually or on a single occasion, neither necessarily induces any toxic effects nor any appreciable protection against the action of the venom when it enters the circulation.

(10.) Mature specimens of the common mungoose certainly may be characterised by a relatively high immunity against the action of both colubrine and viperine venoms, but in the meantime it remains uncertain whether the exemption is of hereditary or acquired character.

The systematic investigation of choleraic materials has been continued and has served to confirm the conclusion that, in so far as Calcutta and the neighbourhood are concerned, cholera is either an exceptionally rare disease or one which is not necessarily characterised by the presence and prevalence of any one species of vibrionic organisms within the digestive tract, and has yielded additional evidence that there is no scientific ground whatever for the assumption that all the vibrionic forms associated with cholera are mere varieties of one and the same species, and that any such assumption can only be regarded as an arbitrary attempt to force facts to agree with popular beliefs.

It has farther been ascertained that vibrionic organisms, belonging to the same group as those which are ordinarily associated with cholera, may abound in the intestinal tract of fishes both in health and disease, and may occur in bodies of water quite apart from the presence of any choleraic disease in the vicinity. The entire mass of evidence afforded by the phenomena of cholera in Calcutta appears thus more and more to favour the belief that, in so far as vibrionic organisms are casually related to the disease at all, it is not because they are capable of giving rise to a specific toxin within the intestinal tract, but because, under certain conditions, they can do so in the environment. In

other words the evidence goes more and more to show that Pettenkofer's original theory was essentially correct, and only requires to be modified in so far that the processes occurring in the environment are to be regarded as processes of manufacture of a toxin, and not of mere maturation of germs.

In addition to the above systematic investigations, casual work of the following nature has also been conducted:—

I. Examinations into the nature of the schizomycete population of samples of water and milk as possible causes of the occurrence of cases of cholera.

II. Determination of the nature of the morbid conditions accompanying the destructive blight of *Areca catechu*, which has been so prevalent of late years in Eastern Bengal.

III. An investigation into the nature of the various species of *Uredinous fungi* giving rise to "rust" in cereal crops in India; and experiments in regard to a possible intermediate host for one of them.

IV. The determination of the true nature of the active principle of the ferment ordinarily employed by the natives of the Eastern Himalaya.

V. Determination of the nature of various vegetable blights affecting tea and other economic and ornamental plants in India.

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ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1895.

(*Surgeon Lieutenant-Colonel W. G. King.*)

Vital statistics.

The population under registration during 1895 amounted to 33,605,784 according to the census, and 36,137,558 according to the estimated population. Areas inhabited by a total of 2,036,044 souls were not under any registration system during the year. This populated consisted of hill tribes, inhabitants of zemindaries, and certain islands on the west coast, where it has not yet been possible to graft this refinement upon existing systems of Government.

Births and Deaths.—The birth and death rates for the whole Presidency were 27·0 and 18·2 per 1,000 respectively. In the following table these are compared with the rates for the previous 14 years:—

Year.	Birth-rate per 1,000 of estimated Population.	Death rate per 1,000 of estimated Population.	Years.	Birth-rate per 1,000 of estimated Population.	Death-rate per 1,000 of estimated Population.
1881	24·4	15·8	1889	26·3	20·1
1882	24·9	15·8	1890	26·8	19·5
1883	25·6	17·9	1891	27·3	22·0
1884	26·4	21·2	1892	24·6	21·8
1885	25·9	19·8	1893	26·1	18·7
1886	26·5	17·6	1894	26·4	19·0
1887	26·5	18·9	1895	27·0	18·2
1888	25·7	18·4			

The birth-rate is, with the exception of that for 1891 (27·3), the highest on record; the death-rate is the lowest on record since 1886.

Remembering that Mr. Stokes' standard for the birth-rate of the Presidency is 42·45, and Mr. Stuart's 52 per 1,000, it might at least be hoped that fairly careful registration would result in a birth-rate being shown of about 40 per 1,000. The following districts, however, reported rates below 30 per 1,000:—

Anantapur	29·9	North Arcot	28·5
Trichinopoly	29·5	Vizagapatam	26·7
Coimbatore	29·1	Nellore	26·5
Tanjore	29·1	Gódávari	24·3
Cuddapah	28·7	Malabar	24·0
Nilgiris	28·5	Ganjám	17·3

There is no reason to believe these rates result otherwise than from defective registration; although in the case of the Tanjore district, the considerable fluctuation of emigration and immigration which has taken place there for some years past cannot fail to have had some influence.

In the case of municipalities, there can, however, be little real excuse for defective registration. It can only result from a want of appreciation of the importance of the matter by Municipal Councils in enabling both Government and themselves to arrive at a just conclusion as to the efficiency of efforts employed to raise the sanitary condition of the people. Indeed, there is still great reluctance on the part of Municipal Councils to prosecute persons who fail to report births and deaths, and it is still the practice in several municipalities to trust to the information gained from peons who, having ascertained cases, give the people forms and invite their attendance at the office. Under such a system, if the peon fails to find a case, the event is not reported, as no action is likely to be taken by persons who are aware that no penalty is probable if they neglect this requirement of municipal law.

Of a total of 57 municipalities, 2 report birth-rates over 45 per 1,000, 22 over 35, 20 over 30, and 13 below this. Of those below 30, Cuddapah has, with reference to prevalence of malaria, a reason for absence of fecundity; but there would seem to exist no valid excuse in the case of Madura (29·0), Cocanada (20·2), Chicacole (21·6), and Berhampur (24·2). In the case of Cocanada, special representations were made to the municipality and the Collector of the district as to the neglect of registration during the year, with the result of ultimately securing some improvement in working,

but too late to exhibit any effect on the total statistics for the year. Chidambaram was shown by the last census to be undergoing decrease of population; but, granting this is so, I cannot regard the birth-rate of 24·0 otherwise than with suspicion, especially as the decrease has occurred less gradually than might reasonably be expected. Thus, in 1893 the rate was 29·9; in 1894 28·5, and in 1895 24·0.

In 20 municipalities death-rates show increase when compared with last year; but it must be remembered that 12 of these also show a marked rise in the birth-rate. This means, in short, that increased attention has been paid to registration generally.

For every 100 boys there were 95·8 births of girls registered; for every 100 deaths of males there were 95·4 deaths of females.

The infantile mortality of the Presidency was at the rate of 162·3 per 1,000 of births; but, as this rate is very far exceeded in towns—making allowance for the greater mortality that might be expected—the chances are that it is much lower than the truth, and that numbers of infants are buried without registration. Lest I be misunderstood here, I would state that there is no reason to think female infants are got rid of as suspected in other parts of India. On the opposite, Madrasees, though not appreciating female births, are, as a race, most devoted to, and careful of, their children. If there be truth in my opinion, the result must be due simply to the tendency for deaths of infants being held as of less importance than adults, and, consequently, more likely to escape observation of subordinates responsible for registration. The rate I obtained as a standard from 23 not abnormally unhealthy municipal towns in 1894 was 176·25 deaths per 1,000 of births.

I need hardly remark that a most delicate test of the sanitary state of towns—especially of the cleanliness of the soil of their sites—can be obtained by studying the rate of infantile and child mortality. The higher figures point just as conclusively to the towns possessed of sewage-sodden soils, or, what amounts to the same thing, filth-contaminated soils with fluctuating and high sub-soil water levels, as the actual sanitary survey does. Thus gauged, the sanitary state of municipal towns must be considered as far from satisfactory, although, as remarked in a former report, infantile mortality is doubtless aggravated by ignorant domestic hygienic and medical care.

There was a total of 658,719 deaths for the Presidency. These were returned under the following heads:—

	Percentage of deaths.
Cholera	3·2
Small-pox	0·8
Fevers	42·1
Dysentery and diarrhœa	3·6
Injuries	1·6
All other causes	48·7

The ratio per 1,000 of the census population of these various deaths causes will be found in the Appendix Statement No. 17.* But to form any accurate idea of the degree of prevalence of these diseases when compared with former years the totals must be reckoned upon the estimated population. Regarded solely in the light afforded in the tables referred to, it will be found that I should have to account for a rise in the mortality from fevers and "all other causes" from 8·0 and 9·3 in 1894 to 8·3 and 9·6 in 1895 respectively, whereas the increase is, in all probability, but ·1 in each case. Small as the difference between the two calculations is, namely, ·2 per 1,000 of the estimated population, it would represent in the Presidency that 13,500 deaths had occurred more than the probabilities of the case would warrant:—

Year.	Birth-rate per 1,000 of the estimated population.	Death-rate per 1,000 of the Estimated Population.						
		Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other causes.	Total.
1891	27·1	2·9	1·2	7·1	1·0	0·3	9·3	21·8
1892	24·4	2·3	1·3	8·1	0·9	0·3	8·8	21·7
1893	25·9	0·9	0·8	7·3	0·7	0·3	8·5	18·5
1894	26·1	1·2	0·3	7·6	0·7	0·3	8·8	18·9
1895	27·0	0·6	0·1	7·7	0·6	0·3	8·9	18·2

* Not reprinted.

These figures, however, show that, whilst there has occurred a slight increase under fevers and "all other causes" in the rates, there has been a satisfactory decline in the prevalence of small-pox, cholera, dysentery and diarrhœa. Taking into account the higher birth-rate registered, and, remembering that this would operate adversely upon the total death-rate until the period of risk to infantile life is passed, it may be concluded that, although no decided improvement in the general health of the population can be demonstrated, the year was, on the whole, healthy, and compared favourably with the average of the preceding quinquennium.

Chief Diseases.

Cholera.

In the year under review a total of 21,172 deaths from cholera occurred, against 43,427 in 1894. In the first month of 1895 cholera was present in the following 13 districts:—

1. Chingleput,	6. Malabar,	10. South Arcot,
2. Coimbatore,	7. Nellore,	11. Tanjore,
3. Ganjám,	8. North Arcot,	12. Tinnevelly, and
4. Madras,	9. Salem,	13. Trichinopoly.
5. Madura,		

The districts of Madura, South Arcot, Tinnevelly and Tanjore were affected with cholera throughout the year.

The districts yielding the chief mortality from this cause were Tinnevelly (4,649 deaths), South Arcot (4,307 deaths). Both districts have water-supplies liable to contamination in a very marked degree: tanks and irrigation channels that run through large tracts of country and pass villages *en route* being the chief sources of water-supply. As illustrating how cholera may be conveyed by irrigation channels (of which there is ample proof) even when not subjected to the defilement incident to passing a village, I may cite a case that occurred a day previous to my last inspection of Palamcottah. A native was brought in from the rice fields in a state of collapse. He had undergone all the usual symptoms of vomiting and purging in his field, over which the surplus water passed to the irrigation channel at a lower level. In a widely-irrigated tract of country it may well happen that mysterious cases of cholera may be thus originated, in that the irrigation water is used for drinking and "other domestic purposes" by all villagers.

In 57 municipalities a total of 1,447 deaths from cholera were registered. In nine of them the deaths did not exceed 10 in each case. The bulk of the mortality was distributed between Trichinopoly (290), Chidambaram (216), and Madras and Periyakulam (115 each).

Small-pox.

The presence of this disease was reported in all districts, but the total deaths for the Presidency did not exceed 5,111, or 0·1 per 1,000 of the population; or, when reckoned on the estimated population, the rate was 0·1 against 0·3, 0·8 and 1·3 for the three previous years. The district of Malabar, which has been long notorious, showed the decreased mortality of only ·03 per 1,000. Anantapur, Bellary and Kurnool returned the highest rates, namely, 0·5, 0·6 and 0·6, respectively. The deaths of children below one year and 12 years amounted to 1,111 and 1,966, respectively.

From 38 municipalities 292 deaths were reported, or a total of 0·17 per 1,000 of their united populations. In Guntúr and Vellore the rates per 1,000 were 1·3 and 1·2 respectively. Of towns reporting the presence of small-pox, Madras and Tuticorin registered a mortality of only ·006 and ·004 respectively.

Fevers.

A total of 277,337 deaths were registered in districts and municipalities from fevers. The district of Vizagapatam showed the high rate of mortality of 18·2 from this cause, or 4 per 1,000 over and above that registered last year, which again was an increase on the previous period. There is no reason to think this implies any actual increase of incidence of fever in this district. But even this high rate is exceeded by that recorded for the Nilgiris, namely, 19·2 per 1,000 of the population. Certain parts of the Nilgiris are malarious and parts of Vizagapatam are markedly so; but in these instances the increase must be regarded as due to greater attention to registration by the Revenue officers, coupled with ignorance of the subordinates employed. Thus, if the statistics for Vizagapatam be accepted, it must be supposed that only 2·5 of the total mortality of 20·7 per 1,000 was due to any cause but fever, and, as to the Nilgiris, that all but 5·7 per 1,000 was so brought about, whilst although undesirable, the total death-rate (24·9) is not so great as to lead to the suspicion that a large

increase over normal mortality of the locality had occurred from one special disease. Cuddapah and Kurnool, both notoriously malarious districts, follow with a death-rate from fever of 16·0 and 15·1 per 1,000 respectively.

In the case of municipal towns, Cuddapah, as formerly, exhibits the highest rate (18·3) from this cause, followed by the chief town in the Presidency, namely, Madras, with 14·2 per 1,000.

Dysentery and diarrhœa.

A total of 23,937 deaths were recorded from these causes. The rate for municipalities is markedly in excess for districts as a whole, namely 3·4 per 1,000 of population against 0·7 per 1,000. Even making allowance for indifferent registration, I consider the result sufficiently striking in pointing to the influence of the usual concomitant of communities living under the evil hygienic conditions found in most of the municipalities up to date, namely, foul and damp soil, and water subject to fæcal contamination; where to these conditions the use of brackish water is added, the incidence of diarrhœa and dysentery becomes greater, for example, at Vizagapatam Karúr, and Tuticorin, where the rates range from 10·3 to 7·6 and 6·3 respectively.

Suicides, injuries, &c.

The practically unvarying proportion of injuries and suicides, namely, 0·3 per 1,000 of the population, was returned. This implies a total of 10,357 deaths from these causes arranged as follows:—

Suicides	1,913
Wounds and accidents	6,248
Snake-bites and killed by wild beasts	2,196

Sanitary Works.

Municipalities.

During the year, the Special Committee of the Legislative Council held numerous meetings for discussion of the various proposals suggested to Government for the revision of Act No. IV. of 1884, under which all the municipalities, with the exception of Madras town, which has a special Act, are administered. The result of the committee's work was the incorporation of several important sanitary measures. Had the country possessed a completely organised and equipped Sanitary Executive Department, it would, doubtless, have been an easy matter to have made several further improvements; but, even as they stand, the additional powers that are proposed, in respect to food and water protection, the combating of infectious diseases, and improvement of administration must prove in the near future of very great advantage in stimulating general sanitary advance. The revised Bill was at the end of the year still under criticism by the Legislative Council, but it is hoped, before the issue of the next annual report from this office, the new Act will be in operation.

In last year's report, I called special attention to the very backward condition of the municipal towns of the Presidency in the matter of conservancy, and suggested that important as the subject of new and protected water-supplies was, it must be almost regarded as a refinement to provide at a cost of some lakhs a town with a water-supply, knowing that the simple question of night-soil removal was attended to in the most perfunctory manner, and that, even after the admission of water, no improvement in this special respect could follow, in the absence of any intention to adopt the "water carriage system." Hence, I argued that it was a mistake for municipal councils to consider that the borrowing of money for sanitary works should be confined solely to provision of water and sewarage works. I then suggested that the Sanitary Board should consider the subject of how sewerage of the towns now provided was likely to be conducted in the future, so that the pushing forward the completion of conservancy might be entered into, it being obvious that should "water carriage" be ultimately adopted in the town, it would not be advisable to press the acquisition of special plant when it might be required to be shortly discarded. Government, having thereupon referred the question to the Sanitary Board, decided that in view of the indebtedness of towns lately provided with public water works and the probable rate of introduction of complete sewerage schemes, it would not be necessary to retard provision of special plant for conservancy of towns other than Ootacamund and Cuddapah, both being likely to be provided with underground sewerage at an early date. Since then the Government has directed that full estimates for the correct conservancy of each municipality should be framed. This, I consider, a measure likely to prove of benefit of a most comprehensive and radical nature.

In consideration of the high rate of expenditure on account of carting and the very filthy process involved, I trust that in the larger towns it will be possible, in the absence of underground sewerage systems, to utilize the Shone ejector method for despatch to depôts of night-soil as practised in Warrington, England, in combination

with destruction of refuse by incineration in localities where its sale is not remunerative, or disposal is attended with doubtful sanitary conditions.

Rubbish incineration was a favourite method of disposal of town rubbish in this Presidency twenty years back, and there are to be found in several municipalities incinerators of the old pattern, for the most part, however, neglected, or only used for ocular demonstration to inspecting sanitary officers of the process not having been quite forgotten. This disuse has been in part due to increasing use of town rubbish by ryots to whom it is sold, and to the fact that in wet weather such incinerators were useless. So far as India is concerned, the incineration process can only be said to have just passed through the experimental stage. Hence rapid adoption cannot be expected, nor is it universally necessary; but there are obviously localities where incineration offers the only solution of rubbish disposal. Calicut is an example of a municipality where both rubbish and night-soil disposal present unusual difficulty. It is further a town where the distances to be traversed are very heavy. Under these circumstances, in 1893, I advised the municipality to arrange for the conduct of their conservancy by the aid of a tramway and to incinerate their rubbish, and manufacture poudrette for export to the planting community in the neighbouring Wynaad Hills. The municipality pressed the question of the tramway energetically, and have, with the consent of Government, entered into an arrangement. The making of poudrette still, however, has not been effected, owing apparently to the non-erection of the experimental incinerator. In Masulipatam, a Silchar incinerator was duly erected during the year. In the town of Madras the difficulties attending the disposal of rubbish has reached an acute stage. The municipality collects the rubbish in open carts in which also large amounts of human excreta are stored. The mixture is duly deposited in tanks and other localities having depressions, in proximity to the dwellings of human beings. Having regard to the condition of the sub-soil water of this town, irrespective of other generally acknowledged facts as to "made-soil," the process cannot be said to be otherwise than highly dangerous to human life. In this respect Madras has been left far behind in sanitary advance by mofussil municipalities. I am, however, glad to be able to report that I believe this is the last year when Madras will thus add to the already long list of causes of preventible mortality within its limits. Government has placed at disposal a grant of Rs. 3,50,000 for purchase of conservancy plant, and for the erection of incinerators.

Under the private scavengering system in municipalities, there has been a considerable increase during the year—a total of 38,310 houses being conserved under this method against 35,252 in 1894. These increases occurred chiefly in Palamcottah, Guntúr, Cocanada, Vellore, Periyakulam, Mayávaram and Dindigul.

The allotment for sanitary purposes made by municipalities during the year amounted to Rs. 16,23,540. The amount devoted to sanitation varies with the individual municipalities. Thus, omitting towns wherein special works of a costly nature were in progress, the allotment varied from 77·5 per cent. in the case of Vizagapatam to 18·4 per cent. in the case of Anantapur. Certain Municipal Councils also failed to utilise a reasonable proportion of the allotment within the calendar year.

	1894–95.			1895–96.		
	Amount sanctioned.	Amount expended.	Rate per cent. of Expenditure to total Allotment.	Amount sanctioned.	Amount spent in Nine Months ending with December 1895.	Percentage of Expenditure to total Allotment.
	Rs.	Rs.		Rs.	Rs.	
For conservancy - - -	4,95,210	4,65,506	93·8	5,23,901	3,69,982	70·6
For improvement of village or town sites.	2,59,556	2,29,844	88·5	2,45,577	1,58,139	64·3
For improvement of water supply, cleansing, repairing, and construction of tanks and wells.	5,00,326	2,72,627	54·4	7,23,917	1,40,359	19·4
For sanitary arrangements during fairs and festivals.	4,910	5,346	108·8	5,440	4,681	86·0
For construction and repair of markets and slaughter-houses.	48,888	25,708	52·6	49,493	16,947	34·2
For other sanitary objects - -	68,209	80,750	118·4	75,212	35,142	46·7
Total -	13,78,099	10,79,781	78·3	16,23,540	7,25,250	44·6

The above table shows a considerable but still not satisfactory increase of attention to the question of conservancy, or, in other words, to the cleanliness of town sites, in that additional latrines, conservancy plant and staff have been provided during the year. In the matter of latrines those erected are much superior to those hitherto employed, as all sanitary works costing over Rs. 200 have to run the gauntlet of the criticism of the Sanitary Board.

There are very few municipalities where it can be said that the storing or treatment of night-soil and rubbish after collection has any approach to exactitude or ordinary care. The night-soil and rubbish depôts are usually "out of sight and out of mind" of the caste members of municpal bodies, and, in certain of them, it can have been but rarely that those responsible have made visits to these places to ascertain in what manner arrangements are conducted. Further, even if they did, they have had no one available who could interpret intelligently any orders on the subject until recently when the municipalities have had at disposal certificated sanitary inspectors. It is hoped that when these men are employed more freely, they will be given by the Councils every opportunity of attempting to prove by object lessons the advantage of the use of night-soil in its various prepared forms as manure. Mr. Gooch, Chairman, Anakapalle, has specially applied to this office to obtain a certificated sanitary inspector, so that this matter may be put on a correct footing. In Cocanada also a special municipal garden has been opened for the purpose of cropping over night-soil. Negapatam reports securing excellent crops of jowari and raggi over night-soil trenches.

Twelve months is in certain respects a considerable period of time for attainment of progress, but when confronted with the various difficulties that are to be encountered in introducing reform, it seems often short enough. At least this is the case as regards sewage farming. In every town inspected where facilities for sewage farming exist, the necessity has been duly impressed upon the Council, but actual progress is decidedly slow. Nevertheless, the record of the year's work is not quite bare. In reference to my remarks in the report of 1893 on sewage farming, both Tanjore and Madras were called upon by Government to attempt improvement of methods employed. In the case of Tanjore, plans and estimates are now under discussion by the Sanitary Board, and it is hoped that before the end of the current year this place will possess a model sewage farm.

In the town of Madras certain of the more glaring defects, as to which I alluded in the matter of conduct of sewage farming, were rectified during the year. Thus one of the lifting stations serving the Kistnampet farm, and which each Sunday used to cease work, and allow the crude sewage to pass into the Cochrane canal, was abolished, the sewage being carried on to the farm direct by an alteration of the sewage pipe line. Still, however, this farm fails to deal with sewage for a period varying from a few hours to some days subsequent to rainfall sufficient to have caused soakage of the ground. During this period, as the cultivators find that moisture suffices for their purposes, sewage is no longer placed upon the soil of the farm; backing up of the sewage then occurs in the sewers, and relief is afforded by discharge into the Junction Canal, whence the sewage reaches the Cooum. In the DeMellow's farm, a single downpour of rain is sufficient at times to render the soil unfit for receipt of sewage till the lapse of even three days. Throughout this time, the sewage backs up in the sewer and discharges behind inhabited houses, where during part of 1895 it collected in stagnant pools that were diminished by soakage in the soil and evaporation, or found its way to a neighbouring tank. These conditions were, however, undergoing much amelioration at the hands of the Municipality during the year. It remains to be seen whether this will materially alter the insanitary arrangement hitherto pursued at DeMellow's farm of relieving the accumulation of sewage by pumping it untreated direct into the surrounding ditch, whence it passes by a tank to Cochrane canal, and thus to the Cooum, which passes through the heart of the city, and is a stagnant cesspool. Into the Cooum also is allowed to pass direct the crude sewage of the minor farms on its banks during the period of saturation of the soil. It is obvious that under-draining of plots, where this measure is applicable, or the use of sewage filters or a combination of both methods should be pursued, so as to receive sewage whilst the ground is suffering from soakage by rainfall, and is for this or other reason temporarily in an unfit condition for receipt of more moisture, and even the sewage diluted by rainfall should be treated before discharge up to a reasonable extent. With this view of matters, Government agreed in G.O., No. 818 M., dated 10th May 1895, Local and Municipal. As the question of sewerage of the town is now before the Municipal Commission, it is presumed that these and other obvious defects of otherwise well-conducted sewage farming will be duly remedied.

In the proposed scheme for sub-soil drainage and sewerage in the town of Cuddapah, the Sanitary Board suggests the use of a correctly underdrained sewage farm. This will form part of the Sanitary Works programme for 1896–97. Vizianagram during the year submitted proposals for sewage farming, but my inspection of the site showed that it would be unsuitable, owing to its being water-logged by neighbouring rice cultivation. Action, however, is being duly taken by the municipality for a new site, and I trust by next year this town may be added to the slender list. Vizagapatam has provided in this year's budget a sum of money for opening a sewage farm. Erode reports that it has commenced sewage farming on a small scale during the year.

In the matter of advance in sewage farming it has to be held in mind that as the majority of the towns have no complete drainage systems, much cannot be expected for some time to come, beyond the use of sewage on small plots by broad irrigation. I believe, however, that there exists a large opening for the purifiation of sewage by filtration. It often occurs that the sewage of two or three streets is brought by the imperfect drains at disposal to a point where soakage is permitted in great pools where land is not available, or direct pollution of streams and tanks occurs. Thus at Vizianagram, I found that the huge mass of water known as the Peddadcheruvu, which for years on end has been a constant source of nuisance to the inhabitants, receives a large quantity of the total sewage of the town *untreated*. During my inspection, under my advice, the municipal council erected a temporary sewage filter having earthen banks clay-lined and charged with under-drained broken metal, gravel, and sand, which simple expedient acted efficiently. It is hoped the municipality will now similarly treat the whole of the sewage of this part of the town, pending it being possible to make the expensive intercepting sewer necessary to lead it to a sewage farm, and thus prevent pollution of the tank. In this town I also attempted the introduction of a household sewage filter, which has since been tried at Negapatam and Coimbatore and Bellary. The idea of filtering sewage at the household is, of course, not original. Dr. Poore specifically refers to this mode in his "Rural Hygiene," and Mr. Scott Moncrieff also practised it. There is, however, much scope for adaptation. Thus, in the form used here, I employed a simple iron kerosine drum having a central funnel whereby upward filtration through stones, gravel, and sand was employed. The action of this simple and inexpensive filter is very good up to 10 to 15 days. The filtrate is clear and odourless. But this provides indifferently for the essential of sewage filtration, namely, æration of the filtering media on account of these being more or less water-logged. This form would, therefore, be best combined with a second filter to receive the filtrate of the first by downward filtration, the first filter acting more as a strainer. I have recently made other forms of domestic filters allowing of forced æration by a hand bellows, and by the intermitting action of a syphon.

I consider that the adaptation of sewage filters to the requirements of native households will effect much good in those localities where no drains exist. Seeing that the filtrate is allowed to soak on the ground surface (unless it happens that vegetation is at hand) the device does not get rid of the difficulty that soakage and dampness of soil is still not prevented. Still, it is better that the threshold of a poor man's house should be soaked with a fairly pure sewage filtrate than with pools of untreated sewage, or that he should launch his sewage into the sub-soil direct by means of pervious cesspools as largely practised. In using this method for the first time, it is of course essential to see that the whole area on which crude sewage has formerly soaked near a house be correctly cleansed, and that fresh earth be placed in position. The filtration media when they require to be changed form good manure.

In the case of Vizagapatam, much of the sewage of the town is sent direct into the swamp caused by the backwater. The result is that the swamp is an abominable nuisance. Here, also, I found an admirable case for filtration of sewage before discharge. The Chairman, M.R. Ry. B. Suriyanarayana Sastri, quickly fell in with my views, and had made whilst I was there an under-drained sewage filter. He describes the results as follows:—"The amount of sewage daily dealt with is about "7,200 gallons (= 750,000 per acre); the filtrate is clear and looks like pure water. "At first a few days after the filter began to work the filtrate tasted brackish, now it "is not so."

A considerable gain in the matter of the repression of epidemic diseases was obtained during the year by the action of the Government in regard to the failure of the Municipality of Trichinopoly to take adequate precautions, in spite of advice offered as reported by me during the epidemic of cholera in that town in 1893–94.

when 1,500 persons perished. In their order on this subject, Government affirmed the responsibility of municipalities, especially in regard to prompt action upon advice offered by the local sanitary officers or by this office. This plain declaration of policy has been, I believe, instrumental in securing during 1895 a far greater display of energy in endeavouring to repress an epidemic at its commencement by municipalities than has hitherto been the case in the history of this Presidency.

Beyond the improvements effected under major works, advance in the all-important matter of improvement of water-supply has been less than could be wished, but it is far more difficult to get a municipality to act in the matter of protection of water-supply than the disposal of sewage. Sewage is a nuisance that all are glad to get rid of, and so long as the expenditure contemplated is not very great, petty schemes for its removal are readily voted for; but to persuade a council that water they have used day by day for many years on end—albeit that their less lucky contemporaries who also used it died prematurely—is unfit for use is not so easy a task. There is still a decided tendency to regard the dipping of hands, feet, and chatties into drinking-water tanks as a matter of little consequence, in virtue of the self-purifying powers of water. Even where the question of the introduction of a public water-supply is discussed, there are always to be found members who will strongly oppose any other mode than the bringing of water into the usual type of open tanks within the town. Nevertheless, under expenditure for improvement of water-supply, there has been an increase this year over the past that bespeaks a certain amount of energy in this matter. I conceive that a want of familiarity with apparatus and methods usually employed to fulfil sanitary ends is at the bottom of this want of appreciation. This can only be got over effectually by the opening of a public museum of hygiene, that should serve to illustrate fully the practical side of municipal sanitation.

The Sanitary Aspects of major Works discussed by the Sanitary Board during 1895.

Ootacamund.—As a result of a sanitary survey, aided by analyses conducted by the Chemical Examiner of samples taken at the different sources of supply at various parts of the storage reservoir, and at definite depths in them, I reported in my inspection notes embodied in G.O., No. 648 M., dated 23rd May 1894, that there could exist no doubt that the Marlimund reservoir was unfit for the purpose of storage, its bed—as subsequently proved by samples removed from the bottom by the Acting Sanitary Engineer Mr. Ellis—being formed by a mass of vegetable matter, which consisted of but partly transformed peat subject to ready decomposition. Within the catchment area is a coffee estate, which contributes impurities of animal origin.

It was therefore advised that the existing reservoir be abandoned and a new storage reservoir be built, that catchment areas where unusual masses of vegetable matter undergoing but slow change in the depths of dark and thickly-wooded jungle should be abandoned, in favour of clean grass land which was available, and that certain springs be collected to compensate for ground thus lost. The whole question was fully discussed, after inspection of the reservoir and catchment area by the full Board (Colonel Pennycuick, C.S.I., Chief Engineer to Government, President, Mr. Jones, Sanitary Engineer, and myself). It being found impossible to supply a few houses without resort to the Marlimund reservoir, I advised the use of Anderson's revolvers previous to subjection of the water to ordinary sand filtration before distribution. The general principles laid down were accepted by the Sanitary Board, its conclusion being aided by a very careful and detailed report on the subject by Mr. Ellis, Acting Sanitary Engineer. There being, however, much engineering work to be undertaken before a complete scheme could be formulated, the Sanitary Board advised the entertainment of an engineer who could devote his time to its special investigation.

In the above inspection notes I drew attention also to the defective state of the "intercepting sewer" at Ootacamund, showing that it was incapable of fulfilling its supposed functions. This matter was also discussed by the Sanitary Board, and its failure was ascribed to imperfect laying by the local engineer. In connection with this matter, the question of sewage farming for Ootacamund was discussed.

I took the opportunity at a special meeting of the Municipal Council of Ootacamund to urge the necessity for their taking up the question of the sewerage of the chief part of the town at the time of altering the intercepting sewer, so as to derive its full advantages.

The reclamation of the upper lake of Ootacamund and the improvement of the ground already reclaimed by sub-soil drainage were also questions discussed by

the Sanitary Board. Govefnment was advised that both works were sanitarily necessary.

Salem.—This is one of the towns that not only suffers from impure water, but also from scarcity of supply. Mr. Ellis, Acting Sanitary Engineer, having proposed a sub-soil water scheme, the Collector of the district in the interest of the municipality brought the matter before the Sanitary Board. The Sanitary Board advised the tapping of the sub-soil stream at its probable outlet—the river. But a sanitary survey by me showed that this would be undesirable, and I advised the tapping of the sub-soil near the Namem Hill, and pointed to possible additional sources in certain springs and surface water proceeding from the back of the Gurumallais. This matter is under investigation.

Cuddapah.—My inspection notes, No. 182, dated 7th February 1895, discussed fully the causes of excessive prevalence of malaria in the town of Cuddapah, in reference to obstructed sub-soil and surface water flow, and saturation of the sub-soil with sewage from pervious cesspools. I urged a pipe sewerage system accompanied by a complete sub-soil drainage system, and the filtration of the existing public water-supply. With the views expressed, the Sanitary Board concurred.

Coonoor.—In my inspection notes (G.O., No. 800 M., dated 6th May 1895) I urged that the source of supply selected by the Sanitary Engineer should not be accepted by the Municipal Council without further investigation as to other possible sources; and, especially, that it should not, even if chosen, be used without the precaution of using filtration, and cutting off certain undesirable portions of the catchment area. I suggested that a source partly discussed by the Sanitary Engineer might be feasible if certain adaptations were made, but which I had not had time to investigate. Subsequent inspection of this source by me, however, showed that it was not sanitarily preferable to that already selected by the Sanitary Engineer. We, therefore, met at Coonoor and exchanged views, with the result of advising an investigation of a new source that seemed to us more likely to yield an unexceptionable supply.

Bezwada.—In my inspection notes (G.O., No. 521 M., dated 23rd April 1894) I warned against the selection of a site for water supply of that town on the ground that, though wells were to be sunk in a reclaimed part of the river-bed, their position was such that a draw upon the sub-soil water of this undrained town was possible. This matter was still under discussion at the end of the year by the Sanitary Board.

Gudiyáttam.—In my inspection notes (G.O., No. 1237 M., dated 1st August 1895) I pointed to Gudiyáttam, though small in population, as a town where, on account of frequent visitation of cholera, it was most desirable a protected water-supply should be obtained. In default of it being possible for so small a town to bear the charges of a sufficiently complete scheme, it was suggested that a cheap system of distribution should be employed, looking to infiltration galleries in the river sub-stream as a source. The Assistant Sanitary Engineer thereupon presented a scheme which usefully modified the rough proposals made by me. The scheme was, at the end of the year, still under discussion by the Sanitary Board.

Calicut water supply.—In my inspection notes (G.O., No. 513 M., dated 23rd April 1894) I objected to the use of the Mananchera tank as a source of water supply that had been selected by the Sanitary Engineer's department, until further investigation had been undertaken. I advised that the sub-soil water in the neighbourhood of Calicut should be explored, with the object of obtaining a site less open to objection as to purity of the area drained. If, however, the Mananchera tank were used, I showed that the chances were it would be found that it possessed not only a supply from the sub-soil, but that probably during excavation the impermeable stratum supporting the sub-soil water had been penetrated, so that a subterranean source had been tapped, which contributed to the total bulk. It was then pointed out that, whilst the sub-soil water in this particular position was objectionable, it might be possible to utilize the tank or its neighbourhood, provided an iron cylinder were sunk, that should, whilst giving egress to the subterranean flow, completely cut off that from the sub-soil. The Chairman of the Municipality has since forwarded to Government proposals that, with the exception of suggesting a concrete ring in lieu of the iron cylinder, coincide with the above; but has, at the same time, apparently from failure to consult my notes at time of his writing, attributed to me views that were not expressed by me. In the meantime, Mr. Ellis, Acting Sanitary Engineer, had proposed the use of certain springs in the neighbourhood that, in the event of the theory as to a subterranean source not being verified, offers an excellent alternative. The matter was before the Sanitary Board at the end of the year.

Works completed during the Year.

Only the following two works were completed and opened for public use during the year 1895:—

Adóni waterworks (population 28,305).—This is a surface water scheme commenced in November 1893. The storage tank is an old one, and was formerly used for irrigation purposes. Much of the catchment was originally rice land. This the Municipal Council has duly bought up. The remaining catchment area is not without objection—being largely cultivated land. The Municipal Council has been advised to acquire the rights over the valley by purchase as early as possible. The town is supplied by gravitation from filtered water reservoirs. The three filters measure 50′ × 40′ each, which, with two in action and one out, will permit of filtration of the 230,000 gallons required at a rate a little over Koch's limits. The water enters the filter-beds at single points on one side instead of being distributed as evenly as possible. The filtering head is controlled by telescopic pipes; but the man in charge has to trust to the use of a rough stick and tape, as no gauges are provided. I have urged the Sanitary Board, without avail, to render the filtering speed of filter-beds as largely under control of automatic arrangements as possible, in view of the poorly-educated class of men likely to be entertained in municipalities for charge of these works. No arrangement exists for filling the filter-beds on starting from below with filtered water. The only place available for drying the washed sand of the filters is a verandah of a house. The collection of sand for the filter-bed was during the year from undesirable localities. The filtered water reservoirs are incompletely dark, and inefficiently protected from heat and dust by a corrugated iron roof. These are all readily removable sanitary faults.

The Tanjore waterworks (population 54,390).—The water is obtained by pumping from an infiltration bed in the river Venár. On the banks within a hundred yards of the filter-bed is a chatram in which a cholera patient died in 1894. I have advised the municipality to abolish this; otherwise the site is not objectionable. I found on inspection that the engines ceased work on Sunday, so that on each seventh day the people were dependent upon their old contaminated sources, and aspiration through empty pipes of undesirable matters was possible. I have advised the municipality against this. The purity of the water in the case of this town will have to be watched carefully, as the rate at which the water from the surface flow, when the river is not dry, passes to the collecting well through the filter-bed, must vary considerably with the rate of pumping. The Sanitary Engineer informs me that he intends suggesting the making of a service reservoir that will receive all surplus water pumped, and will thus keep the pipes full and prevent the danger of aspiration during intermittence. This will form an important sanitary addition to this work.

Sanitary Results of Works completed.

1. Madras.—(1.) The public water-supply having been introduced in the various divisions of the Madras town at different periods, it is necessary to treat the town not as a whole, but with regard to this fact. Black Town being the locality which is supplied both with a sewerage scheme and public water-supply, it ought to be possible to show a marked improvement in the general health of the population. But no permanent material change for the better can be demonstrated. This disappointing result can only be ascribed to the incomplete manner in which the sanitary works have been carried out. Thus, the Black Town sewerage scheme is on the "open system." This system has its sanitary disadvantages, but still the open *versus* the closed sewerage system for native towns is a question that is still subject to much discussion, and much can be said on both sides of the matter. Personally, I do not like the open method otherwise than when unavoidable in small villages, but there can be no reason why it should not have secured in Madras Black Town obvious sanitary good, had the details as to house connections been correctly completed. The arrangements for a system of night-soil conservancy specially suited for the "open system" of sewage removal have never been more than partially adopted. Again, as to water-supply, notwithstanding the existence of the public water-supply, householders in Black Town, as throughout Madras, use shallow well water, that is, water from the sub-soil that is saturated with filth, as testified to by repeated borings disclosing "made-soil" in many localities. The "old main drain," which is an ancient structure, fit at the best to run off surplus rainfall, I have found by personal inspection to be freely pervious. This old drain runs at right angles to the sub-soil waterflow of Black Town. Yet this daily receives a large amount of sewage that the modern sewer No. 1 fails to discharge,

and is retained there until pumped from it. Can it be imagined that under these conditions of known filthy sub-soil (so filthy that it has been described as of the colour of "tin-sand") that shallow well water is a fit fluid to use even for the washing of domestic vessels, irrespective of its use at times for drinking purposes? It seems to me clearly the duty of the municipality of Madras, if they wish to see results secured by the past expenditure on water-supply and sewerage, as a first step, to see that these shallow wells are shut. Power that would enable them to secure this end has been conferred in the Revised Act, No. II of 1892. The excuse that the private latrines and drains would suffer if the wells were closed seems to me an unhappy way of regarding so urgent a sanitary matter. The amount expressed in gallons actually used per head from the pipe supply in 1894 in the divisions where water has been introduced was 12·6 of the estimated population. This is doubtless scanty; but it must be remembered, though in the outlying parts of the town the supply is limited owing to defective pressure, that in the populous areas this is not so markedly the case, and that more could be drawn off here, if the people had not the inducement of a supply from wells nearer at hand than the public stand-posts.

(2.) I have in special reports shown how open to contamination the Madras system is by reason of intermission and defective pressure where leaky pipes in the filthy sub-soil and fittings are concerned. To this must be added further the fact that the water-supply is received from a doubtful collecting area, flows in an open channel, and is not subjected to filtration before delivery. Until the water-supply of Madras is at least guarded by filtration, and, if feasible, by a covered conduit bringing water from a catchment protected from defilement, and is delivered under reasonable pressure, it is not likely the town will get the full benefit of the expenditure undergone for a water-supply; and as long as the municipality neglects to shut shallow wells used by the people, it is impossible to hope it will secure any marked benefit even if the public supply were itself not open to suspicion.

(3.) The extension of a sewerage system to parts other than Black Town is still the subject of discussion by the municipality as it has been during the last 30 years, notwithstanding the advantage of having had schemes prepared by three European experts at intervals in that period. It is believed that a decision is likely this year.

(4.) In the meantime, a scheme for flushing the river Cooum—which is the recipient of a large proportion of the total sewage and is land-locked—by aid of a canal communicating with the sea near the harbour has received the assent of Government.

II. Madura.—Here a decrease of the death-rate has occurred, since the public water-supply had been opened. But I think it would be premature to ascribe this to the influence of this sanitary work, as the people have had to depend very largely upon their former sources of supply; because the amount of water yielded by the infiltration beds was less than had been hoped by the Sanitary Engineer until, by good fortune, at the end of the year, the completion of the Periyár Works brought surplus water into the river Vaigai. Indeed, not only would this fact militate against drawing conclusions, but I consider the reduced death-rate simply implies increased carelessness in registration on the part of the Municipal Council, as both the birth and death rates have simultaneously decreased without good cause.

III. Coonoor.—Here a general improvement in the death-rate seems to have occurred since the introduction of the sewerage system, although this conclusion must be guarded by the fact that if the statistics were formerly trustworthy, Coonoor has yet not reached the condition of health found in 1886. The chances are, however, in favour of the change being due to the better drainage of the place. Yet a sanitary inspection of the works brings the conviction that much remains to be done. Not only is a considerable portion of the town not attended to, but the arrangements within the houses for connecting with the "open drains" of the system are such as to ensure that a large quantity of the total sewage never leaves private premises. No action in this matter seems to have been taken by the Municipal Council during the year. The encouraging results as to the death-rate ought to induce them to render the system sanitarily complete, by attention to the house connections and flushing arrangements.

IV. Ádóni and Tanjore.—Ádóni and Tanjore water-supplies having been opened only during the year, no conclusion can be drawn; but as in both instances the people still are using largely the old supplies, the full influence for good cannot be expected. In Ádóni the works are appreciated by the mass of the people; but, in Tanjore, there is

much conservatism exhibited even by the highly educated, and the most filthy sources of water supply are still resorted to. On the latter matter, the Sanitary Board made special representations during the year.

V. Kumbakónam.—As remarked last year, the drainage scheme here is merely for the removal of surplus surface water, and, although the unlined trenches dug for this purpose may have some influence in their vicinity in lowering the sub-soil water, it cannot be hoped that any marked improvement in the general health of the town will occur from this work. The existing water-supplies and general sanitary state of this town are unusually evil.

VI. Cuddapah.—Here there would seem to have resulted some improvement on the death-rate following the introduction of a purer water-supply. This is shown both by a rise of the birth-rate and a fall of the death-rate. In view of the theory of propagation of malaria by water, and the late hypothesis of Dr. Manson (supported by the late observations of Surgeon-Major Ross of the Indian Medical Service), there is reason to believe that, in the protected water-supply derived from a clean source, much good has been effected; so that with the further improvements contemplated as to sewerage, sub-soil drainage, and filtration of the existing water-supply, there be yet hopes of making Cuddapah healthy.

District Boards.

No change in the method of administration of district boards was effected; their position being regulated by Act No. V of 1884. This Act is practically devoid of any power by which sanitary efforts can be enforced. Hence, although these boards collect funds and spend a certain amount in the cause of sanitation, they can do but little in enforcing precautions that should form the corollary of their position. The Act has been for some time under the consideration of Government, and now that the revision of the District Municipalities Act is an accomplished fact, it is hoped this will in due order be taken up. Until this be accomplished, very little can really be done in rural areas. Indeed, it may be said that, excluding the united population of the 57 municipalities, the remaining population of the Presidency, viz., 33,499,932 is subject to little sanitary control beyond what can be effected by the aid of "persuasion" exercised by the revenue authorities. For example, granted a union be duly embodied, and members of the panchayet gravely meet in consultation as to the sanitary reform of the village, one of their first orders would naturally be to give notice to persons having buildings and lands in an unwholesome state to effect cleansing, but experience would show them that an owner may allow insanitary conditions to exist safely for 30 days subsequent to receipt of notice, when the Taluk Board may cleanse the place for him *at their own expense.* Similarly, as to protection of water-supplies, the position is not much better; as, whilst if a stream is private property, the Board can enforce certain attention to the preservation of its purity, this cannot be done where the stream is public. Yet, a very large proportion of the total population looks to streams for their water-supplies, whilst the conveyance of cholera by this means from village to village is open to no doubt.

The total sum devoted to sanitary purposes (Rs. 696,498) exceeded that of the previous year by Rs. 41,093. As usual, the proportion to their incomes given by district boards varied within considerable limits; for example, whilst Gódávari, and Tinnevelly gave 15·3 per cent. of their incomes, South Canara, Malabar and Nilgiris afforded but 3·5, 2·6 and 1·9 per cent. respectively. Again, expenditure was subject to equally varying results. Thus, the districts of Gódávari, Kistna, Salem and Madura expended but 31·5, 42·4, 42·5 and 47·9 per cent. respectively of the allotment, and although I somewhat encroach upon history, I have ascertained that by the end of the official year 1895–96 the district of Tanjore had spent but 52 per cent., Kistna 48, and Coimbatore but 47 per cent. under the very important item of improvement of water-supply. Nevertheless, as far as my information goes at date of writing this report, there has been, on the whole, a slight improvement in attention on the part of district boards to the necessity of spending the allotments made.

In the case of water-supply the total allotment amounted to Rs. 1,48,318. Very little of this sum, however, represents new works of a permanent nature. A large portion of it disappears under "staff" maintained for guarding the purity of tanks. Such works as were fulfilled at district board's expense were essentially petty, consisting of repairs to wells, deepening tanks and the like. No district board in this Presidency has yet determined upon any scheme of water-supply that would secure pure water for a whole town, although the average total income, excluding the

Nilgiris, amounts to Rs. 3,69,895 per district. Yet it seems to me that only by undertaking in town after town comprehensive radical sanitary improvements it can be hoped real progress in the rural towns can be effected. If district boards would systematically improve the large towns under their charge, and subsequently hand them over to unions—furnished with more sanitary and financial powers than at present—much more evident results would follow than can be expected by dividing the total available funds into petty allotments of Rs. 150 for this village and Rs. 30 for that, and so on. If permanent improvement were made the result would be, that in lieu of the sanitary safety of water sources being in the hands of human beings, having varying standards of conscience, it would be in the safe keeping of mechanical means. Thus, taking the ordinary case of two watchmen in charge of a village tank at Rs. 6 each, there is expended the equivalent of interest on Rs. 3,200 at $4\frac{1}{2}$ per cent. Mechanical improvements would, in many cases, relieve local authorities of the perennial charge for watchmen. If they cannot meet the cost of special works at once, it would seem but reasonable that, instead of indefinitely postponing efforts, they should seek the sanction of Government to borrow funds.

The number of unions and villages concerned increased by 11 during the year. Government has in various orders to local boards impressed upon them the necessity of seeing that the question of disposal of excreta takes precedence of mere rubbish disposal. Unfortunately, sweepers—persons who will collect rubbish—are obtainable at far cheaper rates than scavengers—those who will collect night-soil. Indeed, in some districts, the prime difficulty as to night-soil disposal is the obtaining of this class of labour. It is time, therefore, that where this is the case organized efforts should be made to attain this end. This can readily be accomplished by local authorities importing these people from more favoured localities, and guaranteeing them certain privileges as to huts and lands. In short, efforts should be directed towards founding colonies of these people. This seems a small matter to dilate upon, but the gradual extinction of the scavenger before the advance of education in this country threatens to be a matter quicker of accomplishment than the abolition of caste, whilst, with every attempt at sanitary advance, increased demands upon the manual labour available will present difficulties that could eventually only be overcome by the application of expensive mechanical measures. Of course, the founding of colonies cannot stay the influences of the advance of education in lifting the "toty" beyond the sphere of his present conception of a suitable professional career; but there would result a better distribution of available labour, and numerous low-caste families that would not, in the immediate vicinity of their native places undertake this menial work, would not hesitate to do so when settled elsewhere.

Arrangements as to fairs and festivals, I consider, have, during the year, undergone improvement. There is more tendency by local authorities to work out what is required in each case with the aid of the district sanitary officer, who is now, as well as this office, supplied with an intimation a fortnight before the occurrence of each festival. It is premature till experience in future years is obtained to draw definite conclusions, but, so far, it would appear that the timely taking of special precautions at both Tirupati and Tiruvannámalai (the two great festivals that have hitherto contributed to cholera spread in this Presidency) was of considerable utility. Cholera had occurred at Tiruvannámalai in the month preceding the festival, and one imported case occurred there on the last day. In Tirupati, on the opening of the festival, cholera appeared at one of the pilgrim halting places within three miles of the town, and, again, a further imported case took place during the festival. No spread from these centres occurred, owing to the sanitary staff being sufficiently strong and intelligently alert to secure quick and efficient segregation of the affected persons and correct disposal of infective matter. Exceptionally large amounts were spent at these festivals; the new class of certificated sanitary inspectors were employed for supervision of fairly complete menial staffs, and water-supplies were protected from defilement by mechanical means as far as possible—doubtful sources other than sacred tanks being closed. In both localities the district authorities threw themselves into the work involved by a heavy list of recommendations by me with the greatest cordiality. Water drunk hot is a diffusible stimulant, of the advantages of which the native is well aware. Hence, there was found no difficulty in getting pilgrims to avail themselves of the free distribution of water that had been boiled by caste natives, and was still hot, during the seven miles trudge up the hill at Tirupati. But the festivals at these places were, I think, worthy of special notice in recognition of the accomplishment of what has hitherto been regarded as an impossibility. No direct washing of clothing in any tank was permitted. Kerosine-oil tins were provided for drawing water, which were then used on a specially prepared drained spot, where were

placed the usual dhobie stones. In the case of the holy tanks, where bathing is requisite as a part of the religious ceremonies, it was held that washing of the clothing was no part of the ceremony, and that it was but in accordance with the tenets of Hinduism and common cleanliness that before descending into a holy tank the pilgrim should be able to prove that he had already undergone a grade of *bodily* purification. Hence, it was insisted that no pilgrim should descend into a tank for the ceremony of bathing until he had washed himself and clothing outside the tank. At Tiruvannámalai special barricades were made for this purpose, and by carefully controlling traffic the desired end was accomplished. In Tirupati this arrangement was not effected with the full completeness desirable, but at Tiruvannámalai it was carried out sufficiently well to ensure that on the last day of the festival the Ayarkolam, which in former years was a filthy mass of water, was perfectly clear. Of course, this arrangement did not prevent danger, but it at least minimized the chances.

In connection with the conduct of the Tiruvannámalai festival during 1894, I had occasion to invite the attention of Government by a special report to the very indifferent measures taken for the comfort and sanitary safety of pilgrims during transport by rail. In G.O., No. 590 R, dated 20th September 1895, certain regulations were thereupon required of the railway company by Government, and I am glad to be able to state from personal inspection that much improvement upon the former condition of affairs was effected.

In 1890, when Acting Sanitary Commissioner, I drew attention to the fitness of the Jewish method of conservancy described in Deuteronomy, chapter xxiii., verses 12 and 13 for use at festivals. It was not, however, until the Tiruvannámalai festival of 1895 that I had personally an opportunity of seeing it worked on a large scale. It is certainly the most expeditious, cleanly, economical, and sanitarily sound method yet used, and is much appreciated by natives. It being hopeless to expect the pilgrim to take the initiative in this matter—as was expected of the Jew—it was arranged that places at the outskirts likely to be resorted to were guarded by policemen. These restricted the pilgrims to a certain portion of a field marked off with flags. Within this area were the requisite holes scooped at regular intervals, each marked by a small piece of up-right bamboo, and strip of coloured rag. A scavenger was kept in constant attendance, and the moment a hole was utilized this man proceeded to the spot, removed the bamboo which marked the site, and by a motion of his foot filled in the hole with the dry earth which had been excavated and placed at the side. I describe this simple mode in detail, not only because of its special suitability for natives, but because it is possible to get men to cover the holes who are not scavengers, as nothing defiling is touched; and where every one of this class at a festival is of the greatest value on account of the difficulty of obtaining them, any method that can be worked without their aid is of practical utility.

It having been found that where local authorities employ conservancy staffs, no account was forthcoming as to the manner of *ultimate* disposal of night-soil and rubbish, a special circular was issued to District Medical and Sanitary Officers, inviting them to note in each report not only as to the mode of temporary deposit, but as to what uses, if any, the materials were placed to. The result has been to show that in many unions these are simply thrown on waste places pell-mell, and that in others no fixed depôts exist. These are points that have been referred to local authorities as cases were brought to light, with the result of securing promises of improved methods, more especially directed to ultimate economical disposal as manure. Reports received from Collectors of districts in the matter of attempting to secure the use of night-soil as manure by the influence of tahsildars upon villagers, go to show that very little actual progress has been effected; all that can be done is to keep the matter constantly in view, and to preach its advantages in and out of season.

General Remarks and Personal Proceedings.

During the year a total of 9,125 miles by rail and road was travelled by myself, and 5,561 by the Acting Inspector of Vaccination and Deputy Sanitary Commissioner, Surgeon-Major C. Mallins, D.P.H. Twenty-eight municipalities were inspected, and full reports on the sanitary condition of each were submitted to Government. Twenty-five unions and 62 villages were also inspected.

Whilst the number of municipalities inspected during the year is less than formerly, the attention given to festival resorts and rural tracts has been greater. This is due to my representation to Government that the system by which, in the course of the year, each municipality had to be inspected by either myself or deputy, was of much less

utility than might be anticipated. A calculation of the time at disposal when allowing for a reasonable rate of travelling, and for fulfilment of other special inspections required by Government showed that such inspections could not be otherwise than superficial, and left no time for entering into the numerous details involved in the sanitation of the larger towns with the attention requisite. Regarded even from the light of physical endurance, the task of inspecting on foot all parts of towns having the large areas found in this presidency could not be regarded as otherwise than demanding considerable time. Further, whilst more time and attention were requisite from me in the matter of repression of epidemics, and the inspection of, and suggestions for, the safe conduct of festivals, the state of the organization of the vaccination department demanded that more time should be devoted by the Inspector of Vaccination to verification of results, which experience daily taught was very requisite. Had it been found that the advance made in municipalities was in any way proportionate to the rapidity and multitude of the inspections made of them, this consumption of time would have been justified; but I found that what with the period required for submission of the report, its discussion by the Municipal Council and orders thereon by Government, and consideration of plans and estimates by the Sanitary Board, there remained but little time before the termination of a year for improvements to be really effected. Hence, to visit a municipality two years in succession, was to find that practically nothing had been done in the interval since last report. Government agreed with this view of matters, and directed inspection of municipalities to be, as a rule, conducted every second year, leaving it to my discretion to visit others oftener where this course would seem requisite (G.O., No. 1280 M., dated 6th August 1895).

To secure that there should be no forgetfulness of the fact that certain recommendations had been made, and that the Councils had duly pledged themselves to make reforms, I suggested that District Medical and Sanitary Officers should be desired, on receipt of copies of the inspection notes of this office, to take cognizance of the improvements that had been agreed to by the Municipal Council concerned and report the fact to me, should there seem to be unreasonable delay in effecting these (G.O., No. 1618 M., Mis., dated 9th October 1895, Local and Municipal).

It having been found by me that recommendations made to municipalities frequently were not fully understood, it was suggested that they should be required to hold meetings before my departure after fulfilment of inspection duty, with the object of enabling all recommendations to be discussed fully. This view was accepted by Government in G.O., No. 1280 M., dated 6th August 1895. The result of this interchange of views has, I think, during the year been advantageous, both in the case of the municipalities concerned and myself, in that I can explain fully what is aimed at, and am able to judge as to difficulties that may have to be overcome.

I was required by Government to investigate the connection between the burial of Moplahs dead of cholera, and an outbreak of that disease that had occurred in Palghat, and to select new burial-grounds. In Calicut, the Moplahs had for many years effected burials under highly insanitary conditions, the sites being close to houses, the inhabitants of which derived their supply from shallow well water. In 1890, the Moplahs living under these conditions died of cholera to the extent of 3·5 per cent., whilst Hindus living in the same town died to the extent of ·3 per cent. of their respective populations. The then District Sanitary Officer, Surgeon-Lieutenant-Colonel Beech, made strong representations on the point, with the result that the often-agitated question of Moplah burial was revived. The municipality was then directed by Government to select sites for new burial-grounds, in consultation with the leading Moplahs. On these sites so chosen, I duly reported. Special reports were also required by Government as to the conditions of burial and cremation near the river at Nellore and at Salem, respectively. Orders were also received for the inspection of 29 Muhammadan burial-grounds within the town of Madras. The latter work occupied a considerable time.

In accordance with G.O., No. 1551 W., dated 10th June 1893, Public Works, requiring the Sanitary Commissioner of a province to sit on committees determining the boundaries of cantonments, I inspected and reported to the military authorities on the proposed boundaries of the Wellington Cantonment.

In the beginning of the year, a severe epidemic occurred within the Lunatic Asylum in Madras. With the Surgeon-General with the Government of Madras, I made an inspection of the asylum, when evidence was forthcoming which seemed to show us that a latrine had been contaminated by a case that was not recognised at first as cholera by the then medical officer in charge; that the brooms used for this latrine and

for the washing of floors in sleeping cells were not readily distinguishable, and that this labour was conducted by the same men; that the pails used for drinking water and for flushing the floors were not readily distinguishable, and may, therefore, have been used indiscriminately, and consequently may, and probably were, plunged into a bathing cistern; that this bathing cistern being open, it could not be said that lunatics did not have access to it as drinking water—the probability being that this was the case. Indirect contamination of this water with cholera excreta conveyed by brooms, hands, and pails, seemed, therefore, probable, and it was accordingly suspected by us that the open cistern had been the medium of spread in the first cases. The suspected water was sent to Mr. Hankin for examination, who stated that it contained bacilli "indistinguishable from cholera." In the epidemic of cholera in the Trichinopoly Jail in 1893, the conditions similarly pointed to contamination of water kept in open cisterns for bathing purposes. In view of the strong opinions held by Indians as to the self-purification of water, it is obviously an error to maintain these in any public institution.

Two central and six district jails were inspected by myself, and two central and three district jails by my deputy. Several sub-jails were also inspected. The results of inspection were forwarded to the Inspector-General of Prisons.

Under orders from Government, the Hill Jail of Párvatípuram was inspected, with reference to the continued prevalence there of dysentery. A lengthy report on the subject was submitted to Government.

The question of effecting radical improvement of the arrangements for water-supply in jails, which was pressed upon Government by me in November 1894, was again brought to its notice in 1895, with the result that orders were issued requiring the Inspector-General of Prisons to forward a list of supplies that demanded attention.

With the Surgeon-General with the Government of Madras certain aspects of the food-supply of sub-jails were considered; with the Inspector-General of Prisons the matter of treatment of water in sub-jails, and the provision of cheap, yet not easily contaminated, surfaces for receipt of cooked food supplies was discussed; special measures were advised as to the too prolonged use of earthen lotahs for drinking purposes.

Tirupati was visited twice during the year; once with reference to a special request of the municipality inviting my opinion regarding a proposed tank for religious ceremonies, and, secondly, for inspection during the festival. A careful inspection of both Upper and Lower Tirupati in the previous year enabled me to detail the measures I considered requisite. In the case of Tiruvannámalai, a full report founded on personal inspection of the locality was drawn up previous to the festival, for guidance of the local authorities concerned. I also inspected this place during actual progress of the festival. Vélánganni and Little Mount were also specially visited during progress of the respective festivals. Tirukkazhikkunrum and Tirukachur (both places where festivals take place) were inspected.

Having regard to the orders issued by Government as to improved arrangements for pilgrim traffic by rail (G.O., No. 590 R., dated 20th September 1895) in connection with my representations as to the Tiruvannámalai festival, the Agent of the South Indian Railway, Captain Shelley, R.E., suggested a conference with me, accompanied by the officers responsible for traffic and medical arrangements on the South Indian Railway. It was agreed to invite Mr. Castle-Stuart Stuart, Collector of South Arcot, as a representative revenue officer known to take an interest in sanitary advance, to aid the committee with his advice as to district organization. It was resolved to forward recommendations to Government; but, when finally circulating the Proceedings of the Committee, it was found that the concessions made by the railway authorities beyond what was required by the Government order were so trivial, that the whole subject required reconsideration. A further conference has been consequently suggested. In the meantime, the display of willingness on the part of the Agent to meet the sanitary requirements and the discussion of the various points involved in their various financial, administrative, and sanitary aspects, cannot fail to secure increased attention to this important subject.

Mr. Hankin's suggestion to undertake disinfection of wells with permanganate of potash was pressed upon the notice of all district medical and sanitary officers and all local authorities, by means of circulars. Special tables showing weights of permanganate required for different sizes and shapes of wells under ordinary conditions of organic purity, were also circulated for the guidance of medical subordinates. The method has been freely practised. On the whole, the opinion of district medical and

sanitary officers is that this mode is of efficacy; but this cannot be confirmed without prolonged experience, as indeed contended by Mr. Hankin.

Disinfection of wells by alum and lime was practised by me at the festival of Tirupati in 1893, with apparently good results. In view, however, of Mr. Hankin's advocacy of permanganate, I now confine the use of this method to unmanageably large water-supplies, and especially to use in bathing and washing tanks. Failing its being possible to use even this method, on account of the bulk of water in certain tanks in the Tiruvannámalai festival, I directed precipitation to be affected at nights, after withdrawal of the pilgrims within 25 feet of the edges, a method better than none—having regard to the known slowness of diffusion of impurities in quiet masses of water.

Circulars, giving hints to non-professional persons as to investigation of outbreaks of cholera, describing "make-shifts for sewage disposal in the absence of sewerage systems," in which the various temporary expedients applicable were discussed, and calling attention to the desirability of registration of births and deaths, and affording reasons why members of Municipal Councils should not treat, with the leniency hitherto exhibited, delinquents under the compulsory clauses, were circulated to local authorities. A translation of Koch's paper, advocating subsoil water for sources of supply, provided the area drained is cleanly, with special reference to his suggestion for protection of wells that seems peculiarly applicable to so-called "step-wells" in this Presidency, was also circulated for general information.

As Government has required that I shall not enter into dissertations in the annual report as to cholera causation, I have purposely avoided any theoretical discussion as to the marked decrease of cholera prevalence in this Presidency—a decrease not equalled through eight years. Holding in view, therefore, the fact brought to notice in the annual report of the Sanitary Commissioner with the Government of India for 1894 that, with the proof of connection of the cholera bacillus with cholera causation, the subject of fluctuations of epidemic prevalence cannot be considered closed, and remembering the fact that at long intervals great depressions of cholera prevalence have occurred in the history of this presidency, it would be unsafe to draw a deduction that might by next year be shown to be false, by an exacerbation. Still, I think, it would be illogical not to describe this decrease *to some extent* to the better activity on the part of all local authorities in connection with prompt repression of epidemics. In each instance of an outbreak inquiry is at once made by this office as to measures being taken, and where action on the part of local authorities seems dilatory, special representations are made. This continued "worrying" of local authorities, as this system has been graciously described to me by certain of those concerned, has, I believe, not been without its influence, in that the process having been impartially applied to every part of the Presidency has secured what was aimed at—the taking of prompt and effective measures at the outset of the disease, instead of waiting till the panic of heavy mortality compelled action.

The proposals made by me to Government last year for arranging as to prompt and correct action by all municipalities for the prevention and repression of epidemics, were referred to a committee for discussion, consisting of Mr. Crole, First Member, Board of Revenue, Surgeon-Major-General Sibthorpe, Surgeon-General with the Government of Madras, Mr. Francis, I.C.S., Acting Under-Secretary to Government and myself. The recommendations of the committee entered fully into the question of finance, sanitary organization and administration, and the outline of sanitary measures to be adopted. The various proposals were then placed before the Municipal Councils by Government for discussion. Final orders have not yet been received.

Government was advised that when an outbreak of cholera occurred at a festival, a special report should be sent to this office as to measures undertaken, irrespective of the ordinary festival report (G.O., No. 296 L., dated 15th February 1895).

The evidence before the "Royal Commission on the water-supply of London," showed that whilst the transmission of cholera by rivers was credited, it was believed that but little evidence was actually on record. I have consequently thought it worth while working out evidence on the point. I have thus been able to show in an irrefutable manner from official records that cholera affected villages in the course of three streams for long distances. An inquiry as to the influence in this respect of the Cauvery (which passes through five districts) has demanded much time in working out, but, so far as I have yet been able to gauge the results, this river must be regarded as an important factor in the spread of cholera in this Presidency.

The impression gained during medical practice, judging by frequency of attention demanded by the two classes, is that on the whole cholera attacks adults more than

children. This is a point that can only be settled by large statistics. An investigation of the ages of 1,000 deaths from cholera was accordingly made, with the result of showing that, with the exception of the first year of life, where in this country nourishment is chiefly derived from breast milk, the incidence is fairly uniform :—

—	Rate per 1,000 of the population of that age.	—	Rate per 1,000 of the population of that age.
Under 1 year of age	0·3	Under 20—30	0·6
1—5	0·6	30—40	0·6
5—10	0·6	40—50	0·7
10—15	0·5	50—60	0·8
15—20	0·6	60 and over	0·5

The gradual increase of small-pox in other parts of India, caused me to send a special warning in May 1895 to all local authorities, pointing out that an invasion of the Presidency might later on be reasonably expected, and advising them to maintain special vigilance as to the appearance of the disease, to attempt segregation wherever possible, and push forward not only vaccination of infants and children, but to impress upon the adolescent population the desirability of practising re-vaccination.

With the object of ascertaining whether I was warranted in pushing re-vaccination, inquiry was made as to the ages of a 1,000 deaths from small-pox gathered from the latest and contrasted with the oldest records available, in the hope that it would be possible to determine how far the absence of re-vaccination had in a partly vaccinated population affected the age of death by small-pox. The result is to show that this influence is already at work though not so demonstrable as in Great Britain, in that the protection of the infantile vaccination although shown up to 20 years rapidly declines :—

—	Per 1,000 of Deaths.		—	Per 1,000 of Deaths.	
	Oldest records.	Latest records.		Oldest records.	Latest records.
Under 1 year of age	3·1	2·7	Under 20—30	0·07	0·08
1—5	1·3	1·2	30—40	0·08	0·08
5—10	0·3	0·4	40—50	0·04	0·06
10—15	0·3	0·1	50—60	0·04	0·04
15—20	0·1	0·09	60 and over	0·01	0·04

An investigation as to the decline of small-pox in municipal towns in this Presidency gave the following statistics, showing marked improvement as time advances :—

Years.	Deaths from Small-pox per 1,000 of the united Populations of Municipalities.		Years.	Deaths from Small-pox per 1,000 of the united Populations of Municipalities.	
1876	1·2		1886	0·7	
1877	—	(Famine year).	1887	0·9	
1878	1·6		1888	0·6	
1879	1·1		1889	0·8	
1880	1·2		1890	1·1	
1881	1·2		1891	1·5	
1882	1·3		1892	1·2	
1883	2·4		1893	0·5	Vaccination compulsory in all Municipalities.
1884	3·9		1894	0·1	
1885	0·9		1895	0·1	

With the prospect of special increase of small-pox following introduction from other presidencies, it remains to be seen during 1896 how far Madras has been capable of resisting the invasion.

The overgrowth of prickly-pear in the neighbourhood of villages is a matter of considerable economical and sanitary importance in this Presidency. I therefore suggested to one of the municipalities the introduction of the cochineal insect for its

destruction. In the course of a search for this insect, I was informed of the destruction of prickly pear said to have occurred in the Ponnéri Taluk. Specimens were obtained through Mr. Sirajudin, Tahsildar of Chingleput. The leaves were found covered with a growth that was pronounced by a local expert consulted to be mycelial. I informed Government of the occurrence and pointed out that as I had no time to make a special investigation on this point, it would be advisable to ask collectors and others to make inquiries in districts as to any parasite likely to be capable of being artificially propagated and applied for the destruction of prickly pear. Subsequently, on the leaves from the Ponnéri Taluk being forwarded to Dr. Watt, Economic Reporter to the Government of India, he declared that an insect (belonging to the genus diaspis) was the destructive agent and proved this by actual experiment. He describes the insect as "voracious," and anticipates it could be propagated at central points and be distributed for the work of destruction over various parts of the Presidency. If Dr. Watt's discovery prove correct, it will prove of vast sanitary utility.

In paragraph 65 of my annual report for 1894, I placed on record the first efforts in this Presidency towards the education of Sanitary Inspectors. The Acting Professor of Hygiene, Surgeon-Captain Robertson, undertook the task of delivering the theoretical course of lectures. As the Professor of Hygiene is employed during the mornings as Assistant Physician at the General Hospital, Madras, I was confronted with the difficulty of securing for the candidates a practical course. Finding this otherwise impossible, I undertook it myself. The President of the Municipality of Madras kindly permitted the class every facility for examining works and apparatus. I was thus able to give aid by taking the students from place to place, and making demonstration as fully practicable as possible.

Since this period the syllabus, which was that of the intermediate test in hygiene of the Government Technical Examinations, has been revised, in consultation with the Director of Public Instruction, so as to secure a grade of study specially suited for sanitary inspectors. Holding in mind the indifferent general education in English of some of the sanitary inspectors employed, in placing the proposal for the teaching of sanitary inspectors originally before Government, I asked that I might be permitted to nominate those who had not passed sufficiently good general educational tests, in cases where I considered sound practical knowledge existed. As, however, I found the applications (as I had anticipated) for entrance to the class to assemble in January 1896 were very numerous, I had no difficulty in declining to exercise the power of nomination, and was thus able to at once raise the standard of general education. I therefore required that, except in the case of sanitary inspectors nominated by municipalities that had been engaged in this work prior to December 1894, none would be received, unless they had passed an examination in general knowledge not lower than the matriculation of the Madras University, were medical subordinates of not lower rank than hospital assistants, or were passed engineering subordinates of not lower grade than sub-overseers. Ninety-six candidates registered their names under these conditions, of whom 61 paid the requisite fees for the theoretical course and examination.

A register has been opened in my office for certificated sanitary inspectors, so that local authorities can apply for their services; 23 municipalies have now certificated sanitary inspectors in their employ. The District Board of Trichinopoly has also, as an experimental measure, employed two as Taluk Sanitary Inspectors for rural sanitation. To ensure that their educational standard should be maintained, I have asked District Medical and Sanitary Officers to kindly undertake the oral examination of these men once yearly. Most of the municipalities have also agreed to my proposal to provide them with the College text books of Hygiene, and the weekly periodical, the "Sanitary Record." By these means, it is hoped they will be kept in touch with advancing hygiene.

The question of re-organization of the Sanitary and Vaccination Department on the lines proposed by the Government of India was referred to me for report at the close of the year. This has been since duly attended to.

In response to my request, Government has been pleased to make a grant of Rs. 2,000 for supply of bacteriological and other scientific apparatus for this office. As the Deputy Sanitary Commissioner, Surgeon-Major Bannerman, has taken leave with the special object of revivifying his bacteriological knowledge in the British schools, it is hoped it will be possible to conduct investigations of the ordinary type in connection with sanitary investigation during 1896.

The work fulfilled by District Medical and Sanitary Officers will be found in the appendix. The amount of inspection fulfilled has decreased more than one-half, in

consequence of Government directing that inspections by these officers should be confined to unions, and that this work should be delegated to their assistants more frequently than hitherto. All reports made by District Sanitary Officers are in duplicate, one report going to the local authority concerned, the other to this office. A reasonable time having been allowed to elapse after receipt of their reports, within which it might be hoped local authorities would have attended to their suggestions, abstracts or extracts as to important items were, during the year, systematically forwarded to the local authorities with the request they would kindly note against each what had been done in the matter.

A valuable part of the work fulfilled by the District Medical and Sanitary Officers consists in the examination of the sanitary conditions of schools, as originally suggested by Surgeon-General Bidie when Sanitary Commissioner. This work fell for some years in abeyance, but on reminding the officers concerned by a special circular of the Government Order on the subject, considerable good work has been the result. Recommendations of this class are usually attended to without demur by local authorities, and will doubtless be productive of considerable good. A little money spent in schools for the provision of object lessons in the form of correctly worked latrines, properly protected water-supplies, and the maintenance of due ventilation and cleanliness, would do a great deal more good than any amount of theoretical teaching of hygiene in schools, although this also has its sphere of utility.

On taking over acting charge in 1893, I invited the attention of Government to the anomalous position occupied by the Sanitary Commissioner of this Presidency, in that schemes were prepared for sanitary works by the Sanitary Engineer without his consulting the Sanitary Commissioner. Government thereupon modified the rules of the Sanitary Board, so as to enable this to be effected. In their Order No. 2380 L., dated 16th November 1894, certain principles were laid down which the Board was directed to follow, and after a short experience definite rules were to be drawn up. These were discussed at special meetings of the Board in June 1895 and received, before the end of the year, the approval of Government. The constitution of the Sanitary Board is such that the Sanitary Commissioner may be readily out-voted by the engineering profession, the President being the Chief Engineer to Government and the only other member being the Sanitary Engineer. There is thus placed a considerable responsibility upon the President of the Board in holding the balance. The rules, however, ensure that the Sanitary Commissioner shall at least have the right to be heard, which is a vast improvement upon the formerly existing condition of affairs. Moreover, as all proposals for sanitary works now pass through the Sanitary Commissioner (as Secretary-General, Sanitation Branch, Sanitary Board) to the Sanitary Engineer (as Secretary, Engineering Branch, Sanitary Board), it is now possible to exert a certain amount of influence as to their character.

The ruling as to sanitary works being drawn up in consultation with the Sanitary Commissioner was not given effect to until subsequent to the meeting of the Board in June 1895; so that works were sanctioned previous to this date for future execution, or are now in progress, which have not been subjected to scrutiny by this office. Since then 117 notes—many being of a lengthy character—dealing with the sanitary aspects of proposed works have been forwarded either to the Sanitary Engineer or the President, Sanitary Board. This work, of course, represents a new tax upon the total time at disposal of this office; but, provided sanitary demands are really met in the works projected in consultation by the Sanitary Board, it could hardly be more usefully consumed.

SANITARY ENGINEERING (1895).

During the year, surveys either for water-supply or drainage, or for both, were completed in three municipalities against four in 1894, and were in progress in three, while additional levels were taken for the water-supply scheme of three others. Of the six schemes, costing in the aggregate Rs. 12,95,000, presented to the Sanitary Board during the year, two schemes for the water-supply of Cuddalore and Tirupati were submitted to Government, and the remaining four, viz., water-supply schemes for Vizagapatam and Bezwada, and the drainage schemes for portions of Tanjore and Kumbakonam, were under the consideration of the Sanitary Board. Besides these, reports were also made (1) on the Hagri and Copper Mountain schemes for Bellary, (2) on the proposed supply of water from the mainland to Cochin, and on the other schemes that presented themselves for the town supply, with rough estimates of costs of

the schemes, and (3) on the proposals to conserve a water-supply area for Kodaikanal. The Conjeeveram water-supply scheme was the only one that was sanctioned for execution during the year. Six water-supply works, estimated to cost Rs. 16,87,850 in the aggregate, were under execution, and of these, the Adoni and Tanjore works were completed, while very little remained to be done at Trichinopoly. Fair progress was also made in carrying out the scheme for the water-supply of Dindigul. In Kurnool, however, fresh estimates for the waterworks had to be prepared and sanctioned during the year in consequence of a change in the site, and work was not begun until near the end of the year. In the case of Conjeeveram, as no trained supervisor was available until November 1895, and as by that time the north-east monsoon had begun, nothing beyond the construction of the drivers' quarters was taken in hand. The improvement of the drainage of Ootacamund received attention, and proposals were made as regards an alternative scheme for the water-supply of Cocnoor. 151 plans and 120 estimates for sanitary works of the aggregate value of Rs. 2,69,342 were scrutinised during the year, as against 100 plans and 102 estimates of the aggregate value of Rs. 1,04,699 in 1894, and new plans and designs were furnished wherever necessary, with the Sanitary Board's proceedings, or separately, as follows:—Hospitals for seven towns, dispensaries for 18 towns, markets for four towns, slaughter-houses for two towns, latrines for nine towns, and miscellaneous plans for eight towns. Type designs for nine sanitary works were issued by the Sanitary Board, and as the type plans and estimates for hospital and dispensary buildings had not been completed by the Consulting Architect to Government, it was found necessary during the year to prepare for temporary use seven plans of different kinds of hospital and dispensary buildings.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1895.

(Surgeon Lieutenant-Colonel J. W. Clarkson.)

General Population.

As directed in Government Resolution in the General Department, No. 2,950, of 8th August 1894, the births and deaths among Europeans and Eurasians are given in a separate paragraph.

Vital Statistics of Europeans and Eurasians.

The European civil population in this Presidency, exclusive of cantonments in quasi-foreign territory, numbers 18,486 persons by the census of 1891. During the year 1895, 358 births and 357 deaths were recorded, a birth-rate of 19·37 per 1,000 and a death-rate of 19·31 per 1,000. By sexes, 191 males and 167 females were born, and as regards deaths 219 males and 138 females died.

The Eurasian population numbers 8,519 persons by the census of 1891, and during the year 1895 the births amounted to 164 and the deaths to 219, or a rate, respectively, of 19·25 and 25·71 per 1,000. Of those born, 94 were males and 70 females, and as regards deaths, 113 males and 106 females died.

The causes from which deaths among Europeans and Eurasians were recorded are given in the following table:—

Causes of Deaths.		Europeans.		Eurasians.	
		Number of Deaths.	Ratio per 1,000 of Population.	Number of Deaths.	Ratio per 1,000 of Population.
Bombay Presidency.	Cholera	—	—	2	0·23
	Small-pox	10	0·54	1	0·12
	Fevers	61	3·30	38	4·46
	Dysentery and Diarrhœa	39	2·11	26	3·05
	Injuries	12	0·65	2	0·23
	Other Causes	235	12·71	150	17·61
	All Causes	357	19·31	219	25·71
Cantonments—Other Causes		4	—	2	—

Of the two deaths registered from cholera, one occurred in the collectorate of Násik and the other in the city of Bombay.

Vital Statistics of Native Population.

Births.—In the Presidency of Bombay, including Sind, during the year 1895 there were 674,304 births registered against 660,268 in 1894. The recorded births for the year under report were thus 14,036 in excess of the number registered in the previous year, and also exceeded the mean of the preceding 10 years ending 1894 by 42,665. By sexes there were 350,115 males and 324,189 females, against 342,911 and 317,357 respectively in 1894.

The following table shows the number of births registered in each year from 1885 to 1895, their ratios per 1,000 of population, and the proportion of males to females :—

Years.	Population.	Number of Births Registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 Male Births the Females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1885 - - -	16,454,414	298,406	274,025	572,431	18·14	16·65	34·79	52·13	47·87	91·83
1886 - - -	16,454,414	303,376	278,177	581,553	18·44	16·90	35·34	52·17	47·83	91·69
1887 - - -	16,454,414	327,500	300,693	628,193	19·90	18·27	38·18	52·13	47·87	91·81
1888 - - -	16,454,414	330,316	304,377	634,693	20·07	18·50	38·57	52·04	47·96	92·15
1889 - - -	16,454,414	312,974	287,515	600,489	19·02	17·47	36·49	52·12	47·88	91·87
1890 - - -	16,454,414	333,698	307,417	641,115	20·28	18·68	38·97	52·05	47·95	92·14
1891 - - -	18,820,346	354,630	328,047	682,677	18·84	17·43	36·27	51·95	48·05	92·50
1892 - - -	18,820,346	337,150	313,517	650,667	17·91	16·66	34·57	51·82	48·18	92·99
1893 - - -	18,820,346	345,424	318,881	664,305	18·35	16·94	35·30	52·00	48·00	92·32
1894 - -	18,820,346	342,911	317,357	660,268	18·22	16·86	35·08	51·94	48·06	92·55
Mean for 10 years	17,400,787	328,638	303,001	631,639	18·89	17·41	36·30	52·03	47·97	92·20
1895 - - -	18,820,346	350,115	324,189	674,304	18·60	17·23	35·83	51·92	48·08	92·59

The recorded birth-rate for the year was 35·83 per 1,000 of population against 35·08 in 1894, and a mean of 36·30 for the previous 10 years.

Of the 24 collectorates and districts the number of recorded births in 1895 was higher than in 1894 in 15, viz.:—Khándesh, Násik, City of Bombay, Admednagar, Poona, Sholápur, Sátára, Ratnágiri, Belgaum, Dhárwár, Bijápur, Kánara, Broach, Kaira, Ahmedabad. The remaining nine collectorates and districts show a decrease as compared with 1894. The registration of births in Sind is apparently defective throughout the province, and especially in the collectorate of Hyderabad. The city of Bombay shows slight improvement in the registration of births over last year. The recorded birth-rate per 1,000 of population for the city of Bombay was 19·07 against 18·35 in 1894, and the mean for the last 10 years ending 1894 was 19·29.

As regards the comparative low birth-rate in the collectorate of Kánara the Deputy Sanitary Commissioner, Southern Registration District, states, "it may be "chiefly explained by the influence of the birth-rate in the forest areas where the "effects of malaria on the mothers is so evident. In the more healthy coast villages "the birth-rate is higher than 30·76 per 1,000, but the general birth-ratio for the "whole of Kánara is brought down by the unhealthy forest villages."

The recorded birth-rates among the urban and rural populations of the Presidency were 29·04 and 36·78, against 27·96 and 36·08 in 1894. Except in the collectorates of Ahmednagar, Ratnágiri, Kánara, Kaira, Karáchi, Hyderabad and Shikárpur, and Thar and Párkar District, the birth-rates were higher among the rural than in the urban population. The same collectorates in 1894, except Kánara and Thar and Párkar Districts, showed an urban birth-rate higher than the rural.

Out of 56 towns in the Presidency, 16 had a birth-rate exceeding 40 per 1,000. Násik, Thána, Mahád, Jacobabad, and Bombay have still very low death-rates.

Deaths.—Among the civil population in the rural, town and cantonment circles in the Presidency, 538,540 deaths were registered during the year 1895. In 1894, 607,179 deaths or 68,639 more than in 1895 were recorded.

The following statement shows the number of deaths recorded in each year since 1885 :—

1885 - - 473,591	1889 - - 518,562	1893 - - 511,831
1886 - - 381,185	1890 - - 463,616	1894 - - 607,179
1887 - - 455,261	1891 - - 513,132	1895 - - 538,540
1888 - - 468,039	1892 - - 611,742	

Of the total deaths registered, 280,866 occurred among males and 257,674 among females, against 316,786 and 290,393, respectively, in 1894.

The computed death-rate per 1,000 of population in 1895 was 28·61 against 32·26 in 1894 and a decennial mean of 28·76. The millesimal rates of males dying to males living was 28·84, and of females dying to females living 28·37. In 1894 these ratios were, respectively, 32·53 and 31·97. For every 100 females who died, 109·00 deaths among males were recorded, but these proportions vary considerably in the following collectorates :—

In Khándesh the ratio of male to female deaths was 111·11 per cent.
„ Thána „ „ 115·75 „
„ Bombay „ „ 112·95 „

In Ahmednagar the ratio of	male	to female deaths	was	112·45 per cent.
„ Kánara	„	„	114·28	„
„ Broach	„	„	110·28	„
„ Kaira	„	„	120·71	„
„ Panch Maháls	„	„	124·44	„
„ Ahmedabad	„	„	114·59	„
„ Karáchi	„	„	116·75	„
„ Hyderabad	„	„	123·56	„
„ Thar and Párkar	„	„	115·11	„
„ Shikárpur	„	„	116·07	„
„ Upper Sind Frontier	„	„	126·69	„

In 1895 the recorded death-rates per 1,000 of population were higher than in 1894 in the collectorates of Ahmednagar and Sholápur, and in the district of Thar and Párkar. The recorded death-rate per 1,000 of population in 1895 was nearly the same as that in 1894 in the collectorates of Sátára, Belgaum, and Dhárwár.

The recorded death-rate per 1,000 of population in 1895 was higher than the annual mean of the preceding 10 years in the collectorates of Khándesh, Násik, Thána, city of Bombay, Kolába, Ahmednagar, Poona, Sholápur, Sátára, and Ratnágiri, and in the district of Upper Sind Frontier. In the collectorate of Belgaum the recorded death-rate for 1895 was about equal to the annual mean for the preceding 10 years. In the remaining collectorates and district the recorded death-rate for 1895 was lower than the annual mean for the preceding 10 years ending 1894.

Deaths by ages.—The mortality amongst children under 5 years of age is high and amounts to 43·43 per cent. of the total deaths, and the infantile mortality under one year is 176·47 per 1,000 living. Under one year the percentage on total deaths was 22·30 against 20·20 in 1894, and in the age-period 1 to 5 years the percentage was 21·13 against 21·27 in 1894. The period of greatest immunity was, as last year, in the age-period of above 10 and under 15, the rate being 7·39 living, or 2·50 per cent. on total deaths. Among old people of 60 and upwards, the percentage on total deaths was 14·81 against 14·66 in 1894.

Deaths by caste or class.—According to the census of 1891 the Muhammadan population numbered 3,501,910 persons, amongst whom in 1895 71,965 deaths were recorded against 80,601 in 1894, the death-rate being 20·55 per 1,000 of population against 23·02 in 1894. The Hindu population amounted to 14,897,629 persons, amongst whom 459,918 deaths or 30·87 per 1,000 of population were recorded. In 1894 the total deaths amongst this race were 520,332, equal to a death-rate of 34·93 per 1,000 of population. Amongst the Christian population numbering 122,089 persons, 2,509 deaths were reported during the year against 2,884 in 1894, the death-rate being 20·55 against 23·62 in 1894. Under the heading "Other Castes" are included all those not belonging to either of the above sects who, by the census of 1891, numbered 298,718 persons, amongst whom during 1895 there were 4,148 deaths against 3,362 in 1894, the death-rate being 13·88 per 1,000 of population against 11·25 in 1894. Among Muhammadans the maximum death-rate during the year (48·84 per 1,000) took place in the collectorate of Násik, and the minimum of 13·10 in Hyderabad. In 1894 the maximum death-rate was 49·00 in Broach, and the minimum 13·62 in the Thar and Párkar district. Among Hindus the maximum death-rate (40·22 per 1,000) was in the collectorate of Sholápur, and the minimum (17·46) in the Thar and Párkar district. In 1894 these rates were in Broach (57·72) and Thar and Parkár (16·32) respectively.

As regards the disproportion in the death-rates of Muhammadans and Hindus in Sind, throughout which province the difference is striking, the Deputy Sanitary Commissioner, Sind Registration District, in his letter, No. 131, dated 15th January 1896, states that "the discrepancies with regard to the recorded deaths among "Muhammadans and Hindus to exist mainly among the rural records. The urban "records show signs of more careful keeping; thus, in Karáchi City, which is the "only town in Sind in which I have a fair control of the registration work, the ratios "of death per 1,000 are, Muhammadans 35·25, and Hindus 32·69. In the other large "towns in Sind the ratios indicate very fairly the amount of attention paid to "registration work by the respective municipalities; thus, in Sukkur the ratios are "Muhammadans 25·37, and Hindus 27·06; whilst in Shikárpur, where the registration "arrangements are very defective, the ratios are Muhammadans 16·76, and Hindus "27·20. As before stated, I have practically no control over urban registration "work outside Karáchi City."

"In the rural circles of Sind, registration is in its earliest infancy and is practically "in the hands of tappedárs and village pátels and mukhis, over whom very little "supervision is exercised with regard to the registration work. The vaccinators "frequently discover discrepancies in the *birth registers*, which discrepancies are "immediately pointed out to the respective collectors, but with regard to the rural "death-rates the vaccinators have little opportunity of applying any check; for the "discrepancies of the rural death-rates the village pátels and mukhis and the "tappedárs can alone be held responsible." He further adds: "In many of the "larger towns and villages of the rural circles the proper census population figures "are not even recorded, consequently the effective checking of the tappedárs' registers "is not possible."

Deaths by causes.—The subjoined table shows the deaths in 1895 arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1894 and the mean of the preceding 10 years. The causes of deaths will be briefly noticed in the next section:—

Causes of Deaths.	Mean for 10 Years, 1885-1894.		1894.		1895.	
	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.	Number.	Ratio per 1,000 of Population.
Cholera	24,848	1·43	33,588	1·78	8,890	0·47
Small-pox	3,186	0·18	3,155	0·17	2,299	0·12
Fevers	349,785	20·10	429,094	22·80	388,848	20·66
Dysentery and diarrhœa	39,475	2·27	34,667	1·84	35,348	1·88
Injuries	5,795	0·34	6,117	0·32	6,051	0·32
Other causes	77,323	4·44	100,558	5·35	97,104	5·16
All causes	500,412	28·76	607,179	32·26	538,540	28·61

Chief Diseases.

Cholera.

Cholera caused 8,890 deaths during 1895, throughout the Presidency, or 24,698 less deaths than in the preceding year. The epidemic prevailed chiefly in the Dhárwár, Sátára, Sholápur, Khándesh, and Ahmednagar Collectorates, where 1,585 or 1·50, 1,354 or 1·10, 1,137 or 1·51, 1,002 or 0·68, and 874 or 0·99 deaths per 1,000 of population, respectively, took place; whilst the minimum mortality occurred in the Broach, Surat, Thána, and Kánara Collectorates, in which there were 1, 5, 53, and 59 deaths, respectively, registered. From the province of Sind no deaths from cholera were reported.

In January a cholera death was reported in Bombay City on the 4th, one in Sholápur town on 6th, and then on 19th in the Ratnágiri Collectorate, in which 33 deaths occurred; 2 more deaths occurred in Bombay City, giving a total of 37 deaths for the month from this cause. In the next month, February, 17 deaths took place in Ratnágiri out of a total of 19 reported for the Presidency, the other cases occurring, one each in Násik and Kaira. In March the cholera ceased in Ratnágiri and other places affected in February, but 29 deaths from this cause were reported from Dhárwár Collectorate, the beginning of an attack which lasted till November. This collectorate does not adjoin Ratnágiri. One death also was reported from Bombay City, and from this month the disease continued endemic in Bombay City to the close of the year. In April 135 deaths occurred in Dhárwár and 2 in Bombay, and in addition the collectorate of Khándesh became affected, 3 deaths being reported, and the disease continuing to the year's end. In the month of May, cholera, besides affecting more severely Dhárwár, Khándesh, and Bombay City, also re-appeared in Násik and Ratnágiri, and deaths were reported for the first time from Kánara, Surat, and Ahmedabad Collectorates, so that eight collectorates were affected and 533 deaths reported. In June, Surat, from which only one case had been reported in the previous month, was free, but except this, the disease prevailed in the same collectorates as in the previous month, and in addition deaths were reported from Kolába, Ahmednagar, Sholápur, and Belgaum Collectorates. The outbreak reached its maximum intensity in Dhárwár and Násik during this month. Eleven collectorates reported 985 deaths.

In July there were no deaths reported in the Kolába and Kánara districts, but the disease broke out fresh in Poona, Sátára, and Panch Maháls districts, and the number of deaths largely increased in Khándesh, Ahmednagar, Sholápur, and Ratnágiri, besides continuing severe in Dhárwár. 12 collectorates were affected and 1,306 deaths occurred. August was the month of greatest intensity. Only in one collectorate, Broach, was the disease reported fresh, but here only one death occurred, and the only death in the collectorate during the year. The number of deaths increased in Khándesh, Ahmednagar, Poona, Sholápur, Sátára, Belgaum, Panch Maháls, and Ahmedabad, but decreased in Dhárwár and Ratnágiri. 1,652 deaths were reported from 13 collectorates. In September, deaths for the first time were reported from Bijápur and Kaira, and there was an increase in the number of deaths in Sátára. In 14 collectorates, 1,043 deaths were recorded.

In October the disease re-appeared in Kolába, Kánara, and Surat districts, and was in every district of the Presidency proper, except Thána and Broach. 1,052 deaths in 17 districts.

In November, Thána, which had escaped so long, though bordered on by Khándesh, Nasik, Ahmednagar, and Poona, was attacked. The deaths in Sholápur, Bijápur, Kaira, Kolába, and Násik increased largely over last month, and 17 affected districts returned 1,485 deaths. In December the cholera ceased in Dhárwár, no death being reported. Kolába reported an increased number of deaths, but though the disease was still in 14 districts, only 608 deaths were recorded.

The death-rate attained the high ratios 1·51, 1·50, and 1·10 per 1,000 of population in Sholápur, Dhárwár, and Sátara Collectorates. In Ahmednagar, Násik, Khándesh and Kolába Collectorates the ratios were 0·99, 0·83, 0·68, and 0·64 respectively. The epidemic although widely prevalent did not show any very serious severity in other parts of the Presidency.

In six towns the cholera death-rate exceeded 2 per 1,000 of population. Of these one is in each of the Khándesh, Ahmednagar, Belgaum, and Dhárwár Collectorates, and two in the Sholápur Collectorate. Out of 56 town circles 26 were affected during the year. The town of Pandharpur in the Sholápur Collectorate heads the number, its death-rate per 1,000 of population having been 17·24.

Out of the 25,143 villages in the Presidency, 729 or 3·47 per cent. were affected by cholera; the highest percentage took place in the Dhárwár Collectorate, where out of 1,299 total villages 143 or 11·01 per cent. were affected. In Sholápur Collectorate out of 713 total villages, the disease appeared in 67 or 9·40 per cent. In the Sátára, Ahmednagar, Poona, Khándesh, and Kaira Collectorates the percentages were respectively 7·89, 5·20, 4·72, 3·54, and 3·28; whilst in the remaining 10 collectorates the percentages were below three.

Small-pox.

During 1895 there were 2,299 deaths from small-pox (1,184 males, and 1,115 females) against 3,155 in 1894, and a decennial mean of 3,186.

The Western Registration District attained a ratio of 0·30 per 1,000 against 0·40 in 1894, and a decennial mean of 0·33. In the Central Registration District the ratio was 0·08 against 0·17 in the previous year, and a decennial mean of 0·13. In the Sind Registration District it was 0·07 against 0·01 in the previous year, and a decennial mean of 0·16. In the Southern and Gujarát Registration Districts the ratios per 1,000 of population were respectively 0·06 and 0·05 against 0·09 and 0·05 in the previous year, and 0·20 and 0·06 the decennial mean. In collectorates the highest death ratio, 0·40, took place in the Kolába Collectorate, and the lowest, 0·01, in the three collectorates of Kaira, Karáchi, and Thar and Párkar. Only the district of Panch Maháls was free. The Presidency rate was 0·12 against 0·17 in the previous year, and 0·18 the decennial mean.

According to age, 26·66 per cent. of the small-pox deaths in 1895 occurred amongst infants under 1 year of age, whilst 54·59 per cent. took place among children over 1 and under 12, the remaining 18·75 per cent. being among persons over 12 years of age.

Fever.

During 1895, 202,528 males and 186,320 females, or a total of 388,848 persons, were reported to have died from fever, against 429,094 in 1894, showing a decrease of 40,246 deaths for the year, the mean for the previous 10 years being 349,785.

In the Central Registration District fever caused a high mortality, 24·45 per 1·000. during the year, against 23·48 in 1894, and the decennial mean 19·33. In the Gujarát Registration District the death ratio was 22·68 against 35·25 in the previous year, and 28·11 the 10 years' mean. In the Western Registration District the ratio for the year was 21·49 against 21·40 in the previous year, and 19·43 the decennial mean. In the Southern and Sind Registration Districts the respective ratios for the year were 16·07

and 15·81 against 17·43 and 16·55 in the previous year, and 16·58 and 17·53 the 10 years' mean. The collectorate of Sholápur heads the list with the high ratio of 30·75 against 27·01 in 1894 and 23·05 in the previous 10 years; and the lowest ratio 7·86 was attained in the town and island of Bombay and 11·06 in the Ratnágiri Collectotate, the Presidency rate being 20·66 against 22·80 in the previous year, and 20·10 the decennial mean.

Excepting in the month of December, the deaths from fever were below the corresponding months of 1894, and excepting the month of November they were above the mean. The maximum mortality from fever took place in December, when 37,307 deaths were reported, and the minimum in February, when 28,438 deaths were recorded from this cause.

Dysentery and diarrhœa.

During 1895 dysentery and diarrhœa caused the deaths of 18,943 males and 16,405 females, or a total of 35,348 persons against 34,667 in 1894 and a decennial mean of 39,475.

The Central Registration District heads the list with a ratio of 3·22 per 1,000, against 2·55 in 1894 and 2·15 the decennial mean. The Western Registration District comes next with a ratio of 2·50, the Southern Registration District 2·10, Gujarát Registration District 0·18, and the Sind Registration District 0·14. In the Presidency the rate was 1·88 against 1·84 in the previous year and a decennial mean of 2·27. In the collectorates of Ahmednagar, Poona, Sholápur, Sátára, Ratnágiri, Belgaum, Dhárwár, Bijápur, Kánara, Karáchi, Hyderabad, and Shikárpur the death-rate for the year was slightly higher, and in the rest it was below 1894. High ratios were recorded in Sholápur 4·34, Sátára 3·88, Belgaum 3·65, Násik 3·64, Ahmednagar 3·42 and Khándesh 3·09, and the lowest 0·06 in Thár and Párkar and Shikárpur, and 0·04 in Panch Maháls and the Upper Sind Frontier.

During the five months from August to December the deaths from dysentery and diarrhœa exceeded those recorded in 1894, but in other months, and excepting July, August and September of the mean, they were less than in 1894 and the 10 years' mean. The maximum mortality occurred in August and the minimum in February.

Injuries.

During 1895, 3,494 males and 2,557 females or a total of 6,051 persons met with violent deaths. The mortality from these causes is less by 66 than that reported in 1894, when 6,117 deaths were recorded. Of the 6,051 deaths, 2,410 happened from drowning, 1,380 resulted from snake-bites, 532 from wounds, 170 from hanging, 140 from poisoning, 80 from attacks by wild beasts, and 1,339 from causes not specified.

Other causes.

The recorded deaths from causes other than those specified number 97,104, of which 50,044 occurred among males and 47,060 among females. The total for 1894 was 100,558, so there is a decrease of 3,454 under this head.

Sanitary Works.—Military and Civil.

All available information under these sections has been thrown in a tabular form, and will be found in Appendices Nos. IV.—V. and the last four columns of Annual Form II., Appendix VI.*

It will be seen from the statement given in Appendix V. that in the 168 municipalities in the mofussil there was a population of 2,237,838 souls and an income of Rs. 47,49,303. Out of this income Rs. 21,50,827 or 45·28 were allotted for sanitary works, and out of this allotment Rs. 18,21,963 or 84·71 per cent. were spent.

Of the total expenditure Rs. 8,69,219 or 47·71 per cent. were spent on conservancy, Rs. 4,96,543 or 27·26 per cent. were spent on improvement to water-supply, Rs. 2,15,979 or 11·85 per cent. were spent on improvement of town-sites, Rs. 77,961 or 4·28 per cent. were spent on construction and repairs to markets and slaughter-houses, Rs. 8,130 or 0·45 per cent. were spent on sanitary arrangements during fairs and festivals, and Rs. 15,431 or 8·45 per cent. were spent on other sanitary objects, including construction and repairs of tanks, &c.

The Bombay Village Sanitation Act, 1889, has been introduced, up to the end of 1895, in 163 villages. Under this Act, if the villagers agree to provide three-sixths of the cost and the local board two-sixths, the provincial fund adds the remaining one-sixth, the principal conditions being that there must be residents in the village willing and competent to serve on the Sanitary Committee and that there are good prospects of benefit arising from the application of the funds provided. The benefits

* Not reprinted.

to be conferred are preserving the purity of the water-supply and attending to the conservancy of the village, and by inducing the leading people of the village to move up the matter, thus to spread an interest in sanitation amongst the people themselves.

Sanitary Board.—During the year the Sanitary Board gave advice on projects for improving the water-supplies at Dakor, Kirki, and Alandi, and on a scheme for supplying Yeola with a water-supply. They also advised on the experimental drainage scheme for Ahmedabad, which has since been approved and sanctioned, at a cost of Rx. 2788; the drainage and sewerage of Parel, a drainage project for the town of Dhulia, a project for constructing an intercepting drain at Nasik, to form the first portion of the complete drainage scheme of that town, and the question of house connections of the Government buildings with the sewerage system of Colaba, with the view of stopping the present system of hand removal of night-soil at Colaba. The Board also gave advice on a number of miscellaneous projects.

Abstract of Report of the Health Officer of the Port of Bombay for the Year ending 31st December 1895.

The following table gives a summary of the shipping and health of the Port of Bombay, and of the work in connexion therewith, for the year ending 31st December 1895 :—

Table No. 1.

Vessels including Native Craft.	Number.	Number of Passengers as far as is known.	Number of Vessels inspected.	Number of Persons, including Crew, on Vessels inspected.	Number of Vessels disinfected.	Number of Persons vaccinated.	Diseases and Number of Cases of each.						
							Cholera.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Enteric Fever.	Cardiac disease.
Entered - - -	48,210	460,483	20	19,140	7	864	11	3	21	1	2	1	1
Left - - -	40,768	418,745	540	80,876	—	—	—	—	—	—	1	—	—
		Including Harbour Population.											
In harbour during the year -	1,339	22,142	12	—	12	15	11	4	—	1	2	—	—
Total - - -	90,317	901,370	572	100,016	19	879	22	7	21	2	5	1	—
1894 - - -	86,560	884,428	661	116,140	39	124	29	4	30	—	2	1	—

In the above table the number of crew on board ships entering the harbour during the year is not shown, as no record is kept.

The discrepancy between arrivals and departures is explained by harbour boats arriving from across the harbour with wood, grass, and other local cargo. On arrival they are noted as "arrivals," and having discharged their cargo depart for similar cargo without being noted as "departures."

Of the 460,483 passengers who are shown in the foregoing table, 14,434 were troops, 10,826 Mecca pilgrims, and the remaining 436,223 principally passengers from ports in close proximity to Bombay.

Infected arrivals.—The following table shows the number of ships which had infectious disease on board on or before entering the harbour :—

Class of Vessels.	Number of Ships.	Total Number of Crew and Passengers.	Diseases and Number of Cases of each.							Number of persons vaccinated.
			Cholera.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Enteric Fever.	Sudden death from cardiac disease.	
1. Troop ships -	2	2,892	—	—	21	1	—	1	—	—
2. Pilgrim ships -	2	1,791	—	2	—	—	—	—	—	848
3. Other vessels -	5	635	11	1	—	—	2	—	1	16
Total - -	9	5,318	11	3	21	1	2	1	1	864
1894 - -	21	7,912	—	3	21	—	1	1	—	110

The above table does not include the cases of infectious disease which occurred on vessels in the harbour, or amongst the harbour population. These will be noticed under vessels in port.

The small-pox cases were removed to hospital on shore, and the ships were disinfected, and those on them unprotected by previous small-pox or vaccination were vaccinated. During the year, 864 persons on board such vessels were vaccinated. The cases of measles on board of Her Majesty's Indian troopship were landed and isolated in the Military Cantonment at Colába. The cholera cases shown in the foregoing table occurred among the firemen on board of the "Bancoora" a few days after she had left Calcutta for Bombay. The deck crew did not suffer from it, although they had used the same water and food. The actual cause of the outbreak could not be traced, but the firemen themselves attributed it to the use of Calcutta coal which was used in the furnaces. The clothes of four persons who died of the disease were destroyed, and the clothes belonging to those who recovered, as well as of the crew generally were fumigated and washed in carbolic lotion. The ship was thoroughly disinfected.

No vessels arrived with suspicious cargo, such as hides of cattle supposed to have died of or suffered from contagious cattle-disease, nor did any vessel arrive with glandered horses during the year.

The following table furnishes the details of the outward bound vessels inspected and granted Form B. bill of health during the year.

Table showing the number of crews and passengers of outward square-rigged vessels and steamers leaving, and of native sailing craft bound for quarantine ports inspected during the year ending 31st December 1895. This includes 26 pilgrim vessels for Jeddah. By quarantine ports are meant—ports of Mauritius, Aden, Red Sea, Europe *viâ* Canal and Persian Gulf—vessels for which, with their crews and passengers, are inspected on the day of sailing before bills of health are granted.

Names of Ports to which sailed.	Number of vessels.	Number of Tonnage (net).	Number of Individuals comprising Crews.	Number of Passengers.	Total of Crews and Passengers.
I.—Square-rigged Vessels and Steamers.					
Europe, viâ the Suez Canal	228	544,988·73	18,777	6,937	25,714
Aden	37	64,521·56	5,210	2,088	7,298
Red Sea ports	9	10,053·97	614	278	892
Suez	—	—	—	—	—
Port Said	2	3,766·61	52	—	52
Mauritius	14	16,939·48	852	1,024	1,876
Persian Gulf	36	40,544·31	821	1,993	2,814
Total	326	680,814·66	26,326	12,320	38,646
II.—Pilgrim Ships with 60 or more adult passengers.					
Jeddah, viâ Aden	26	31,314·88	1,721	17,287	19,008
Total	26	31,314·88	1,721	17,287	19,008
III.—Native Sailing Craft.					
Persian Gulf ports	90	14,117·68	1,994	243	2,237
Other foreign ports	80	9,136·76	1,840	210	2,050
Total	170	23,254·44	3,834	453	42,87
IV.—Her Majesty's Indian Troop, and Marine Ships, and British and Foreign Men-of-War.					
Europe, viâ the Suez Canal	15	57,118	3,282	15,368	18,650
Aden	2	1,371·04	124	81	205
Persian Gulf	1	715	80	—	80
Total	18	59,204·04	3,486	15,449	18,935
Grand Total	540	794,588·02	35,367	45,509	80,876
1894	582	894,692·36	36,961	44,017	80,978

In addition to the above, Form C bill of health was issued to 666 vessels. It is usually taken by vessels bound for Indian, China, and East African ports, where quarantine restrictions are mild, or are only put in force against arrivals from places where epidemics are actually prevailing. The total number of bills of health issued, including form B, was, therefore, 1,206 against 1,177 in the year 1894, and 1,176 in 1893.

The remaining vessels, 39,562 in number, took no bill of health, as they were generally native coasting craft and Shepherd's ferry steamers.

The bills of health, Form B, furnished to the vessels shown in the foregoing table were invariably clean bills, as at no time during the year did the Medical Board declare cholera to have been epidemic in Bombay. But attached to each bill of health was a certificate showing the number of deaths from cholera, yellow fever, and plague in Bombay during the previous week. This necrological certificate has to be produced at certain ports.

During the year, on inspection of outward vessels immediately prior to sailing, no cases of infectious disease dangerous to life were discovered.

The sanitary condition of outward bound vessels was as a rule fairly satisfactory. The principal defects noticed were overcrowded forecastles, faulty construction of crews' quarters, conveyance of deck-passengers on long voyages without suitable accommodation, foul-bilges in native craft.

Infectious Disease on Vessels in Port.—There were 11 cases of cholera, seven of which proved fatal, amongst a harbour-population estimated at 22,142. 10 cases occurred on board native harbour-boats and one on board a steamer belonging to the British India Company. All these vessels were disinfected as thoroughly as possible. Out of the 11 cases, eight received treatment in the Infectious Diseases Hospital, and the remaining three were returned as having died in their boats a few hours from the beginning of the attack. One of the two cases of chicken-pox occurred on board of one of Her Majesty's marine ships. The case of scarlatina was reported to have been removed to the Saint George's Hospital from one of the Indian Troop Service transports on the day of departure from this port. In connexion with the four cases of small-pox, 15 members of the crew of only one ship were vaccinated.

The following table, which deals only with cholera infected harbour-boats lying about the various bandars, shows how high the mortality is amongst those who have suffered from the disease during the last 11 years:—

Years.	Cases.	Deaths.	Percentage of Deaths amongst those attacked.
1885	30	26	86
1886	2	2	100
1887	26	21	80
1888	15	10	66
1889	23	21	91
1890	3	2	66
1891	5	5	100
1892	12	12	100
1893	12	12	100
1894	28	22	78
1895	10	7	70
TOTAL	166	140	84

There may have been a number of mild cases which ended in recovery, and as such were not reported. The usual mortality in cases of cholera attacks in India is about 40 per cent.

Disinfection of Ships and General Health of the Shipping.—Nineteen vessels of various sorts were disinfected during the year on account of infectious disease dangerous to life. The disinfection of ordinary vessels and harbour boats was as usual satisfactorily carried out by the Water Police in accordance with the instructions given by the Health Officer of the Port. The Naval authorities dealt with the disinfection of Her Majesty's Marine and Indian troopships on which infectious disease occurred. None of these ships were kept in quarantine for any time and were only detained for a few hours while they were undergoing the necessary disinfection.

The general health of the harbour population was reported as satisfactory during the year. The Saint George's Hospital during that time admitted 537 Europeans

connected with the shipping and harbour, of whom 24 died; whilst the Goculdáss Tejpál Hospital admitted 197 Natives, of whom eight died and the Jamsetji Jijibhoy Hospital 103 Natives, of whom 10 died. The total number of admissions into these hospitals and deaths were, therefore, 837 and 42 respectively. The principal causes of admission were as usual due to accidents, bowel complaints, venereal diseases, fever, rheumatism, bronchitis, and affection of respiratory system.

Dr. Shroff, the Medical Inspector of Seamen, has reported that there was an outbreak of typhoid fever amongst the mariners of Her Majesty's Ship "Cossack" while quartered in the Royal Alfred Sailors' Home from 15th January to 9th March 1895. Thirty cases in all were sent to the Saint George's Hospital. A committee was appointed by the Rear-Admiral Commander-in-Chief, East India Station, to inquire into the cause of the outbreak. The Committee arrived at the following conclusion :—

"The conclusion formed from the foregoing investigation is, that the outbreak of the enteric fever amongst the ship's company of Her Majesty's Ship "Cossack" is most probably due to an article of diet.

"We are of opinion that the milk is the most likely source of infection; but the watercress may also be a possible source owing to the conditions under which it is grown."

Dr. Shroff thinks that the investigation was somewhat incomplete, as the question of the sanitary condition of the vessel on which the persons attacked had been at work was overlooked by the committee.

Dr. Shroff has also reported that during last year he examined 775 native lascars for service on steamers before they signed Articles. Of these 775 persons he had to reject 110 for heart and venereal diseases, weak chest, and other causes. He mentions that out of the number he had rejected during 1894, 33 per cent. suffered from venereal diseases. During the year 1895 the percentage increased to 42·81, and he observes that the disease has been freely contracted by domestics ashore.

Quarantine against Bombay.—No quarantine was imposed at Suez against Bombay during the year 1895.

No complaints were made by ship captains or agents of vessels—other than those of certain pilgrim ships—of any delays due to quarantine regulations at foreign ports caused to their steamers which left this port in possession of official bills of health, with the exception of the Anchor Line S.S. "Australia" which was detained in quarantine for three days owing to the captain having produced a Turkish bill of health at Barcelona, although he had a clean Government bill of health from Bombay.

In accordance with their resolution, in the General Department, No. 5,496, dated 17th December 1895, Government have finally declared Pir Pao to be the Quarantine Station for the purposes of the B. Quarantine Rules, and have retained for that purpose at Pir Pao the land measuring 9¼ acres as per their resolution, Revenue Department, No. 117, dated 7th February 1896.

The following table shows the number of days during which quarantine was in force at Suez against arrivals from Bombay since the year 1884, with the Bombay cholera deaths of each month :—

Years.	Number of Days at Suez during which Quarantine was in force against Bombay.	Total Number of Cholera Deaths in Bombay City for the Year.*	Number of Cholera Deaths in Bombay City for each Month.											
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1884	250	576	101	33	34	7	70	19	8	73	94	47	50	40
1885	227	598	49	80	149	114	62	23	53	34	20	11	1	2
1886	13	19	3	2	—	1	2	2	—	—	5	—	1	2
1887	66	269	—	1	2	3	1	8	45	103	48	41	15	2
1888	6	379	5	1	10	36	40	54	38	75	68	16	7	29
1889	113	462	108	29	8	14	26	34	108	67	32	12	13	11
1890	Nil.	102	40	15	9	—	1	3	12	7	7	2	1	5
1891	18	146	1	1	4	1	1	1	6	33	73	19	6	—
1892	Nil.	169	1	2	1	12	17	12	26	29	29	27	10	3
1893	Nil.	147	4	—	3	23	23	10	11	31	35	6	1	—
1894†	Nil.	426	1	1	2	8	53	61	134	131	22	8	3	2
1895	Nil.	90	3	—	1	2	8	1	3	8	4	12	38	10

* Including European and Eurasians.
† Cholera was declared to be of an epidemic form between 17th July and 7th August 1894.

Red Sea Pilgrim Traffic.—Twenty-six steamers left with 17,102 souls (pilgrims) for Jeddah and 185 others, principally native troops and followers, for Aden. This is the second largest number of pilgrims which has left Bombay for Jeddah in any one year. The steamers were of the usual class engaged in the trade with the addition of two new vessels, the "Moshtari" and the "Ajmir." On the whole the vessels were fairly well ventilated and provided accommodation at the rate of 9 square feet in the 'tween deck and 6 square feet on the upper deck, or 15 feet in all for each adult pilgrim. The Turkish steamer "Abdul Kadar" made but one trip, and to enable her to carry a fairly large number of pilgrims under the Indian Rules, she had to expend a considerable amount in making alterations and repairs on board.

There is still room for improvement in the ventilation of the 'tween decks of pilgrim ships. Shipowners complain that their ships' decks are damaged and rendered dangerous by being cut up for the large number of small ventilators that are required to give air to the 'tween decks. These tin funnels are screwed into the deck and have to be removed in rough weather. What is required in the absence of machinery for ventilating purposes is a system of substantial iron-shafts, say 6 feet by 2 feet, extending some 12 feet above the deck. These air shafts would not hurt the deck and they could be fitted up against deck houses so as not to be in the way when cargo is being worked. Pilgrims are not an over clean or healthy lot, and as such they require more space and better ventilation than either Native troops or emigrants, who are generally men in the prime of life.

The pilgrims were drawn from all classes of Indian and Central Asian Muhammadans, and in addition an English woman, Australian born, was found among the third-class passengers making the voyage as a pilgrim. She was very purdá, would not give any account of herself, and said she could not speak Hindustáni. The general health of the pilgrims was fairly good. The usual number of very old and young, lame and blind were observed among them. Some owners have taken to removing from their ships pilgrims, who, although free from infectious disease, are in a dying or very feeble condition. Stowaways were numerous during the year. A large Sindi was found in a state of collapse in a box 2 feet 9 inches by 1 foot 7 inches and 1 foot 4 inches. He was removed and resuscitated.

The Haj of 1895 took place on the 4th June and Camaran was opened for the reception of the pilgrims on the 28th December 1894. The usual outbreak of cholera occurred while they were undergoing quarantine at Camaran. Pilgrims on three of the 26 vessels which left Bombay were declared infected with cholera, but this was after they had been on shore for some time.

There were 484 admissions into hospital on board ship and 61 deaths out of the 17,102 pilgrims. The death-rate is therefore 3·56 per 1,000 per voyage. The average duration of the voyages to Jeddah, exclusive of the usual 10 days spent on shore in quarantine at Camaran, was 13½ days. The most common causes of admissions into hospital were fevers, diarrhœa, dysentery, and injuries. As usual the majority of the admissions from diarrhœa and dysentery took place between Camaran and Jeddah which is only a two days' voyage; while the pilgrims were in the lazaretto 147 more died, cholera having claimed 72 of the number. During the prevalence of cholera at Camaran, Government placed a Muhammadan Hospital Assistant at the disposal of the Port Health Officer. He was utilised for observing the pilgrims at the various rest-houses and mussáfferkhánas in the city.

The following is a short history of the outbreak of cholera at Camaran. A very able and full report of this outbreak by Surgeon-Major MacCartie is now before Government.

Cholera is said to have broken out among the pilgrims of three vessels and to have first appeared at Camaran amongst the pilgrims of S.S. "Mahommedi." This vessel left Bombay on 6th March and arrived at Camaran on the 16th idem. She had three deaths during the voyage, one from debility (age 80) on 8th, one from pneumonia on the 8th, and one from phthisis of lungs on the 15th March. On 23rd March, or seven days after landing at Camaran and 17 from departure from Bombay, two of her pilgrims died in lazaretto from diarrhœa; and on 24th the sanitary officials declared cholera to have broken out, and imposed 15 days' additional quarantine from that date. Cholera cases occurred at intervals with resulting fresh periods of quarantine up to 8th April; and the vessel finally re-embarked her pilgrims on 24th April and arrived at Jeddah on 27th April, having undergone at Camaran a period of 39 days' quarantine, during which time according to the report made to the Commander by the Camaran officials 54 of her pilgrims died, and of these 28 succumbed to cholera. It is worthy of notice that cholera cases are said to have occurred at Mecca on the 21st April and at Jeddah at an earlier date when the "Mahommedi" pilgrims had not even arrived at the latter port.

The next ship was the "Jubeda," which left Bombay on 16th March and arrived at Camaran on 25th of same month. On the voyage to Camaran three deaths occurred—old age (two), ages 75 and 85, and phthisis of lungs (one); dates of deaths in order of disease 22nd, 24th, and 23rd of March. The Medical Officer gave medical treatment to 39 pilgrims on the voyage to Camaran, and not one of these had any diarrhœa or symptoms suspicious of cholera. On the 30th March, or five days after landing at Camaran and 14 days from departure from Bombay, cholera broke out amongst the Jubeda's pilgrims, and lasted until 26th April with corresponding quarantine. Finally on 11th May the quarantine was raised, the vessel re-embarked its pilgrims and arrived at Jeddah on 13th May, having been in quarantine at Camaran for 47 days, during which time, according to the Camaran officials, 29 of her pilgrims died of cholera and 16 of other diseases.

The "Huseinee" left Bombay on 10th April and arrived at Camaran on 18th idem. During the voyage she had no deaths, and no pilgrims required medical treatment. On 24th April, *i.e.*, on the 6th day of quarantine, and on the 14th day from departure from Bombay, cholera broke out amongst her pilgrims in camp, and lasted with fresh imposition of quarantine until 25th May. Finally on 31st May, as it was clear that the 15 days' quarantine imposed after each case would, if reckoned from the 25th, prevent the pilgrims reaching Jeddah in time for the Haj, the vessel re-embarked her passengers and returned to Bombay without the pilgrims having been able to perform their Haj. They had been for 43 days in quarantine at Camaran, and 22 of them had perished, 15 from cholera and seven from ordinary diseases, all victims to an insanitary quarantine station.

The three vessels, it should be stated, on the voyages to Camaran had only touched at one intermediate port, viz., Aden.

The "Mahommedi," "Jubeda," and "Huseinee" are amongst the very best pilgrim liners in the trade, and their sanitary condition when examined prior to the embarkation of their passengers at Bombay was excellent.

The pilgrims were free from cholera while on board ship, and it was only after being on shore for a period of from five to seven days that it made its appearance among them. The crews of the three ships had the protection of the pure drinking water on board and remained free from the disease, while the pilgrims, who were provided with an indifferent water-supply, were suffering from it on shore. Camaran as a compulsory quarantine station should be abolished, as the drinking water is bad and the sanitation primitive. If it is found impracticable to cease using it for quarantine purposes, condensed water should be issued to the pilgrims and the administration of the island placed in the hands of some authority who would be capable and willing to improve the sanitary condition of the lazarettoes. The present quarantine fees would be more than sufficient to meet all expenses.

Sanitary State of the Harbour and Foreshore.—The sanitary defects of the docks, harbour and foreshore were noticed in the reports for the years 1893 and 1894. The bad corners and berths of the docks were dredged, and no complaints were made of ill-health on board ship or amongst the dock employés. The Port Trustees appointed a special officer to see that the closets of ships were locked while the vessels were in docks. Eleven latrines with about 40 seats have been erected at sites where they were most urgently needed. Mody Bay South Reclamation, which was extensively polluted, has been taken up for the bulk oil installation, and will, therefore, cease to be a nuisance. The swampy foreshore at Mázagaon and Tank Bandars has been reclaimed, and this part of the foreshore has been vastly improved. The mangrove bushes at Sassoon Dock have been removed. The drain for the tramway company's stables has ceased to discharge into the Arthur Basin. This drain was the cause of periodical complaints in former years from the inhabitants of Grant Buildings. The following basins have been dredged; viz., Sand, Chunam, Carnac and Kerosine. Kására basin remains as foul as ever, and will continue so until such time as it is filled in for the proposed new railway, or until the drain is diverted into the Mázagaon Drainage System, which is to be undertaken at some future date.

The sanitary condition of the port has markedly improved during the year, and the Port Trustees deserve full credit for this improvement. The municipal and private drains they apparently cannot interfere with. The retarding elements in the sanitary improvement of the port and foreshore are private owners and the Municipal Corporation. During the year the Pilgrim Ships Act, 1895, received the assent of His Excellency the Governor General in Council, but it has not been brought into force up to the present.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1895-96.

(*Mr. H. C. Williams, Chairman.*)

Town and Bustee Improvement.—In the miscellaneous Capital Budget for 1895-96 the Commissioners sanctioned Rs. 3,92,595 for new drainage and bustee improvements of the town proper as required under Section 37 of the Act (Clause 3). Out of this sum Rs. 45,402 were allotted for bustee and town improvements, besides Rs. 50,000 on account of petty town improvements, allotted from the revenue. The expenditure actually incurred and adjusted in the accounts has been Rs. 74,084-1-4, of which Rs. 21,042-14 were spent on bustee improvements.

Bathing platforms.—The Commissioners have commenced the construction of new bathing platforms at Gazir Naziboolla's Lane and in Maugpara Bustee. Orders have also been issued to prepare estimates for two more—one in Bysack's Lane and the other in Baug Bazar Street, municipal land being available in both cases. The bathing platform at Jorapooker Square has been thoroughly repaired and opened to the public.

Tanks.—Only two tanks, one at 9, Belvedere Road, and the other at 27, Omda Rajah's Lane, were completed during the year.

Waterworks.—The erosion of the river bank at the Pultah Works still causes some anxiety. During the year the banks have been repaired as far as practicable by cutting the banks to a slope and pitching with stone. The length of (filtered) water main now in use amounts to 310·59 miles, 3·59 miles having been laid during the past 12 months. The number of premises connected during the year amounted to 996, and the total number of premises connected is now 26,312. The average daily consumption of filtered water during the year was 20,284,181 gallons. The consumption per head per day works out at 50·09 gallons for the town proper and 20·11 gallons for the added area.

There has been a great demand for unfiltered water during the year; in fact the demand has exceeded the supply. The consumption during the year was 5,692,151 gallons a day. The length of the unfiltered water mains has been increased by 1·54 miles, and the total length of main is now 75·17 miles. In connexion with this main there are now connected 1,216 premises, 151 public conveniences, 86 bathing platforms, 289 sewer flushing chambers, and 2,911 ground hydrants for road watering and sewer flushing purposes. The consumption per head per day (unfiltered water) amounts to 13·43 gallons.

Drainage and General Construction.—The drainage of the Entally Block has been completed so far as it has been sanctioned, and the Bahir Mirzapur scheme has also been completed. The sewers now measure 208·797 miles, including 9·25 miles of bustee sewers. The number of premises connected to sewers during the year was 528, making the total number of connections 29,140. The number of premises connected under the new rules amounted to 73 for the year, or a total number of 988. The drains of premises were examined by the Inspectors during the year, and in 3,071 cases or 47 per cent. defects were found. About 8 miles of kirb and channel stones have been laid in streets. The additional sewers laid during the year measured 1·17 miles, and 1·67 miles have been relaid and re-modelled.

Mr. Hughes' report on the drainage of the suburbs was submitted to Mr. Baldwin Latham for his opinion thereon. This opinion was received in September 1895, and a joint report by Messrs. Hughes and Kimber was prepared dealing with Mr. Latham's suggestions. A pail and cart depôt was constructed at the Budge-Budge Road, and a cast-iron main was laid to discharge the sewage into the Circular Road sewer. The pumping machinery is now in course of erection.

Roads.—There are now 328 miles of roads within the municipal limits of which $103\frac{1}{2}$ are stone metalled, $164\frac{1}{2}$ brick metalled, $35\frac{1}{4}$ over sewered ditches, and $24\frac{3}{4}$ unmetalled.

Vital statistics.

The health of the town was very unsatisfactory, the deaths being as high as 39·6 per 1,000 during 1895, while the birth-rate declined to 16·0 per 1,000. These figures are respectively the highest and lowest known since the amalgamation of the suburbs. The total number of deaths was 27,031, and was made up as follows :—

11,345	deaths from	fevers = 16·6 per	1,000 of population.
2,099	do.	cholera = 3·0	do.
2,220	do.	small-pox = 3·2	do.
3,269	do.	diarrhœa and dysentery = 4·7	do.
8,098	do.	all other causes = 11·8	do.
27,031	Total number of deaths.		

It is noticeable with regard to this that the average price of food was higher in the year than the average of the 10 preceding years, being Rs. 3-12 against Rs. 3-9-4.

The increase from fever was especially noticeable in the canal area of the town, where the deaths amounted to 27·0 per 1,000 of the population.

The supply of good water, so much in advance of good drainage, has largely discounted the advantages to be derived from the improved supply.

The deaths from cholera amounted to 2,099, of which 1,302 were in the town and 797 in the suburbs. The Health Officer has pointed out that, besides the numerous polluted tanks, the influx of pilgrims into the town, and the presence of cholera microbes at the bathing-ghâts add to the chances of the spread of the disease. It will be difficult to drive away these causes of the disease, though the Health Officer hopes they will be diminished.

Two thousand two hundred and twenty persons died from small-pox. Of these, 501 were vaccinated, 420 inoculated, and 1,217 unprotected. Among the latter children especially suffered, being no less than 708. At the "Campbell Hospital" more accurate statistics are taken, and from there it was ascertained that recorded vaccination reduced the mortality by nearly six times.

All available precautions were taken during the year to check the progress of disease.

Vaccination was vigorously pushed on, the number of persons vaccinated being 54,982 against 17,335 in the previous year. 88·88 per cent. of the cases were reported successful in the case of primary vaccinations. Prosecutions for non-vaccination decreased from 562 in 1894 to 321 in 1895, being undoubtedly due to the prevalence of small-pox. There is an increased demand for animal virus every year.

Professor Haffkine's method of inoculation as a prophylactic against cholera was also carried on during the year 1895, when 2,038 inoculations were performed.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1895.

(*Dr. W. J. Simpson.*)

LIBRARY OF THE BOMBAY

Meteorology.

The variations in the atmospheric pressure during the greater part of the year were small, the lowest reading, 29·565, being recorded in July, and the highest, 30·009, in January and December. The mean daily variations of temperature were greatest from January to May and in November and December, and least in August. The mean daily dew-point was highest in July, August, and September, and the mean maximum solar radiation was highest in May. Rain fell during all the months except January, November, and December, the number of rainy days during the year amounting to 110. The maximum monthly total rainfall and the maximum fall in 24 hours both occurred in August.

Price of food.

The price of food was higher in 1895 than the average of the preceding 10 years. Common rice sold on the average at Rs. 3-12 against Rs. 3-9-4 per maund. Fuel sold at an average price higher than, and salt at about the same price as, the average of the previous 10 years. The average price of meat, fruit, fish, and vegetables was higher than the average of the 10 years from 1885 to 1894.

Vital statistics.

The number of births (born alive) recorded during the year 1895 was lower than that recorded during any of the previous six years. There were 10,945 births, giving an annual birth-rate of 16·0 per 1,000 of population. The figures for the past seven years are as follows:—

Year.	No. of Births.	Birth-rate.	Year.	No. of Births.	Birth-rate.
1889	12,317	18·0	1893	13,492	19·7
1890	11,918	17·4	1894	11,438	16·8
1891	12,477	18·3	1895	10,945	16·0
1892	12,688	18·6			

As usual, the greatest fertility was exhibited by the Christians and Other Classes and by the Hindus more than the Muhammadans. According to locality, the birth-rate was greatest in the added area of Burtola, in Hastings, and in the town area of Burtola, and was least in Burrabazar, Waterloo Street, and added area of Moocheepara.

The general health of the town was not good during the year 1895. There were 27,031 deaths, being a mortality of 39·6 per 1,000 of the population, against 22,441, or a ratio of 32·9 in 1894, and against 20,924, or a ratio of 30·7, the mean of the five years 1890 to 1894. The following statement shows the numbers of deaths and death-rates in Calcutta during the past seven years:—

Year.	No. of Deaths.	Death-rate per 1,000 of Population.	Year.	No. of Deaths.	Death-rate per 1,000 of Population.
1889	19,564	28·7	1893	20,103	29·5
1890	20,368	29·8	1894	22,441	32·9
1891	21,517	31.5	1895	27,031	39·6
1892	20,180	29·6			

The decline in the public health in comparison to the previous year was greater in the suburban amalgamated area than in the town proper, and in the area bordering on

the Circular Canal than in the rest of the suburbs. The death-rate in the town proper rose to 35·8 in 1895 against 30·0 in 1894, while the death-rate in the suburban area rose to 47·8 in the year 1895 against 39·0 in 1894; and the ratio in the canal area was 46·4 against 35·2, and in the rest of the suburbs was 48·0 against 39·7. In comparison with the year 1894 the unhealthiness was not confined to any particular ward of the town. For, if the mortality of 1895 is compared ward by ward with that of the previous year, a rise in the death-rate is to be noted in all the wards. In comparison with the mean of the preceding five years, an increase in mortality occurred in all the wards except Alipur, where there was a fall of 4·5 per 1,000 of population.

As usual, the mortality among females was higher than among males, the ratios being 48·9 and 34·7 respectively. The excess in mortality during 1895 over the previous year was due to an increase in the mortality among both males and females.

In comparison with the previous year there is an increase in the death-rate at all ages during the year 1895, but this increase was particularly great under the age of five years. The mortality of infants under one year of age was extremely high. There were 4,663 deaths, being a mortality of 476·0 per 1,000, or a little below half of the infant population. The high mortality among infants is a prominent and discreditable feature of Calcutta, and urgently calls for improved sanitation in connection with the construction and cleanliness of dwellings and the proper regulation of the milk-supply, in addition to an improvement of the general drainage and cleanliness of the town. Though a good deal of any improvement in the health of the infant population will, in the long run, depend on the spread of sanitary education among the masses, and particularly among the female section of the community, a considerable part of it lies within the range of public hygiene; and this particularly applies to the laying down of proper rules and regulations for the construction of sanitary dwellings, and for the control of the milk-supply in Calcutta, to the removal of the defects in the general drainage, and to the adoption of proper means to secure an efficient daily cleansing of the town. The mortality of infants under one year of age was greater in urban than in suburban Calcutta, being 531·9 against 392·9 per 1,000 of infant population, and indicates in what part of the town improvements are more urgently required. It was slightly greater in females than in males, and it was, as usual, greatest among the Muhammadans, and least among the Christians.

The death-rates according to nationality were higher during 1895 than during 1894. The figures are 30·9 anong Christians, 39·0 among Muhammadans, 40·2 among Hindus, and 59·0 among Other Classes in 1895, against 23·5, 31·4, 34·0, and 48·7, respectively, in the previous year.

The main factors contributing to the increase in mortality in Calcutta during 1895 were an exceptional rise in fevers and small-pox, and an increase of cholera and bowel-complaints; and this statement applies to the town proper, the canal area, and the suburbs, both when taken separately and when they are considered as a combined area.

The large number of deaths registered under fevers during 1895 was one of the main causes of the high death-rate in the town. The total number of fever deaths recorded in urban and suburban Calcutta was 11,345, which is an increase of 2,382 deaths above the number registered in 1894. The figures for the town proper and the suburbs in the two years were—

Year.	Town proper.		Suburbs.		Total.	
1894 - -	5,712	12·2	3,251	15·1	8,963	13·1
1895 - -	6,831	14·6	4,514	20·9	11,345	16·6

From these it will be seen that in 1895 there were in the town 1,119, and in the suburbs 1,263, more deaths from fever than in 1894.

The number of deaths from fevers in urban Calcutta during 1895 was the highest on record, exceeding that of every year since 1865, the earliest year of which records are available. The rise in the fever deaths in urban Calcutta is not a sudden one peculiar to 1895, though this year is distinguished by recording a number of deaths which exceeds by 745 the maximum number recorded in any of the previous 30 years.

There has been a gradual steady increase during the past seven years, as shown by the following figures:—

Year.	No. of Deaths from Fevers.	Death-rate from Fevers per 1,000 of Population.	Year.	No. of Deaths from Fevers.	Death-rate from Fevers per 1,000 of Population.
1889 - -	3,341	7·7	1893 - -	4,749	10·1
1890 - -	4,154	8·9	1894 - -	5,712	12·2
1891 - -	4,675	10·0	1895 - -	6,831	14·6
1892 - -	4,632	9·9			

The annual death-rate from fevers in urban Calcutta exceeds that of the suburbs at the amalgamation, and shows every tendency to a further increase unless remedial measures be adopted in the meantime. It is known that scarcity of food is always followed by a rise in the fever ratio. The variations in the price of food, as indicated by the price of common rice, are shown side by side with the annual death-rates from fevers during the past 11 years in the following statement:—

Year.	Price of Common Rice.	Death-rate from Fevers.	Year.	Price of Common Rice.	Death-rate from Fevers.
	Rs. As. P.			Rs. As. P.	
1885 - -	3 5 4	8·8	1891 - -	3 8 9	10·0
1886 - -	2 8 0	7·8	1892 - -	4 6 0	9·9
1887 - -	3 2 0	7·5	1893 - -	4 10 0	10·1
1888 - -	3 4 4	7·3	1894 - -	4 9 4	12·2
1889 - -	3 5 0	7·7	1895 - -	3 12 0	14·6
1890 - -	3 2 0	8·9			

It will be seen that the variations in the price of food bear no proportion to the variations in death-rate from fevers, nor can any direct relation between the two be established in any other way. The connexion between the prevalence of fevers in urban Calcutta and the defective condition of its sewerage system, however, is more or less intimate, and indicates the direction in which remedial measures should be first directed.

As regards the suburban area, the naturally water-logged condition of its soil, rendered worse by the existence of numerous tanks and dobas the waste of water consequent on the introduction of water supply, and the want of drainage, is a sufficient explanation of its fever ratios, and clearly indicates the requirements.

Cholera.

The mortality from cholera was above the average of the previous six years. The number of deaths was 2,099 against 1,955, the hexennial mean, giving a death-rate of 3·0 against 2·9 per 1,000 of population. Of these, 1,302 deaths occurred in urban Calcutta, exceeding the mean of the previous 10 years by 18, and 797 deaths took place in suburban Calcutta, being lower than the average of the preceding six years by 64. The figures for the two areas are as follow:—

——	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Town - - -	1,603	1,741	1,198	1,734	1,079	963	1,553	1,257	596	1,118	1,302
Suburbs - - -	—	—	—	—	1,236	916	1,402	762	273	577	797
Combined area - -	—	—	—	—	2,315	1,879	2,955	2,019	869	1,695	2,099

The mortality from cholera was greatest in Shampooker ward with a death-rate of 5·6 in its extended portion and 5·0 in its town portion, and it was lowest in Bamun Bustee ward, with a death-rate of 1·0, while the average ratio of 3·0 was attained in Jorasanko and Watgunge. Of the remaining wards, all the urban wards south of Machooa Bazar and Cotton Streets as well as the town area of Sukea's Street and suburban area of Moocheepara, and wards Baniapooker and Khidderpur had cholera ratios below the total ratio for the town, while the rest exceeded that ratio. Next to Shampooker, the wards Jorababan, Bhowanipur, Burtola, and Balligunge suffered most from cholera during the year 1895.

As in the previous year, the heaviest mortality was in March and April; and commencing from the latter month, a series of observations were made during the year to ascertain the distribution of *comma bacilli* in the water of the Hooghly river, the Tolly's Nullah and the Circular Canal and in the water of tanks and wells in Calcutta. 104 samples of water were collected and examined, of which 60 were from different points of the river Hooghly, 8 from the Tolly's Nullah, 5 from the Circular Canal, and 31 from tanks and wells. The results obtained may be thus summarised—

Of the water of the Hooghly *commas* were found in	12	samples,	or	20	per cent.
,, ,, Tolly's Nullah	,,	= 6	,,	75	,,
,, ,, Circular Canal	,,	= 2	,,	40	,,
,, ,, Tanks and wells	,,	=19	,,	61	,,

Attention was specially directed to the water of the river and the two canals in consequence of the fact that cholera was largely prevalent among persons who were in the habit of bathing in it or otherwise using it. The tanks, the water of which was examined, were situated in localities where cholera had taken place. The use of their water was at once prohibited, and guards were placed to prevent people from removing or using the water.

Small-pox.

There were 2,220 deaths from small-pox during the year 1895. Of these 1,687 occurred in urban Calcutta, 4 in the Port, and 529 in suburban Calcutta. These numbers are far above those of previous years except 1865. As has been stated in previous reports, small-pox prevails epidemically in Calcutta every fourth or fifth year, and lasts for two years more or less, with intervening years of almost complete freedom. In some epidemics the first year's prevalence is greater and severer than the second, while in others the reverse is the case. In the epidemic during the year under report, which commenced in the beginning of 1894, the latter has been the case. No year, however, passes without some cases. But in ordinary years the cases are single and isolated, and are mostly imported by infected people coming to Calcutta. In such years there is little tendency for the disease to spread, and in certain seasons of the year, especially during the very hot months and the rains, the infectious properties of the disease appear to be extremely slight. In the present state of our knowledge it is not possible to say what the cause or causes of this periodic accession and decadence in the prevalence of the disease are. This much is known, however, that successful vaccination and revaccination usually prevent the occurrence of the disease or modify its virulence.

The epidemic of small-pox in 1895 was a continuation of that which commenced with the beginning of 1894. The disease first appeared at Kalghât in January 1894, and gradually extended to the town and other parts of the amalgamated area. In April and May, 1894, the disease was at its height. In June it began to decline, and was finally stamped out in the suburbs. But in the town it smouldered on, notwithstanding every effort to stamp it out, and cases continued to occur throughout the year. This was a bad feature in the epidemic, and led to the apprehension that the disease would prevail to an unusual extent in the year under report (1895). In fact, from the end of December 1894, the disease assumed renewed vigour, and cases began to occur in large numbers in urban Calcutta and Tallah. These cases came to notice in the beginning of January 1895. To meet the increased demand for vaccination around the centres of contagion, two extra vaccinated calves were employed. But as the disease spread in urban Calcutta and also extended to the amalgamated area, and as from the advertisements issued by the Health Department, the demand for vaccination increased to an unusual extent, eight calves were employed daily, and a very large number of vaccinations and revaccinations were performed both at the stations and in infected localities, as well as in private houses. As the disease, however, continued unabated up to April, six extra Medical Inspectors, seven extra vaccinators, and one Inspector of vaccination were employed, and besides the daily supply of eight calves from which lymph was taken direct, prepared lanoline vaccine was used to vaccinate people in bustees in the vicinity of houses affected with small-pox.

Not only was vaccination vigorously pushed on in infected localities, but the Medical Inspectors promptly disinfected the houses of the small-pox cases, and destroyed the beddings and clothes of the patients. There are many difficulties that stand in the way of carrying out precautionary measures against the spread of the disease in Calcutta. *First*, there is great difficulty in obtaining prompt information of the occurrence of cases. The patients and their friends, particularly among the poorer classes, have a dread of small-pox hospital, and for fear of removal of the patients to hospital, abstain from giving intimation of the occurrence of cases to the sanitary

authorities. Moreover, small-pox cases being rarely attended or treated by ordinary medical practitioners, little assistance is available from that source in the early detection of cases. *Secondly*, the isolation of patients is in many instances difficult or impracticable. The law allows only poor and practically houseless *male* patients to be removed to hospital against their will; and even in the case of such patients removal to hospital, before they have had time to spread the contagion, is frequently impossible in consequence of their friends and acquaintances keeping the occurrence of the cases as secret as they can. The law gives no power to the sanitary authorities to isolate females and infants by removal to hospital; and infants under five years of age were the greatest sufferers from small-pox during 1895.

From May the disease began to decline, and although isolated cases continued to occur in some of the wards of the town and amalgamated area in June, July, and August, it died out altogether in September. From October to December there was not a single case of the disease among the residents of Calcutta, though the following cases were imported into the town and admitted in the Small-pox Hospital at Sealdah, viz., on the 14th November, 1895, *S. S. Dalhousie* arrived at Khidderpur with a small-pox case on board. On the 2nd December a cooly recruit arrived at 21, Garden Reach Emigration Depôt, From Fyzabad, and got small-pox immediately after arrival, and was removed to Sealdah Hospital on the 16th December; and two cases were imported from Kashipur, a village on the south of Taratola Road, very close to, but not within the jurisdiction of Calcutta. But the epidemic tendency of the disease being over, these cases did not lead to the spread of small-pox in the town.

Of the 2,220 deaths that occurred in 1895, 420 were reported as inoculated, 501 as vaccinated, 3 as previously having had small-pox, and 1,217 as unprotected, that is, as persons who had never been vaccinated or inoculated, nor had had natural small-pox.

Dysentery and diarrhœa.

The mortality from dysentery and diarrhœa was considerably higher than that of any year since 1889. There were 3,269 deaths from this cause against 3,136 in 1894, and against 2,769, the mean of the six years 1889 to 1894. Of these 1,599 deaths occurred in urban Calcutta, exceeding all the corresponding figures of the preceding decade except 1885, and 1,670 deaths took place in suburban Calcutta, which is considerably in excess of the corresponding figures of the previous six years.

Other causes.

The mortality from all other causes in 1895 was lower than that of the previous six years except 1890 and 1891, and fell below the hexennial mean by 83. There were 8,098 deaths against 8,242 in 1894, being a mortality of 11·9 against 12·0.

Vaccination.

Vaccination against small-pox was carried on vigorously during the year 1895, and particularly during the first five months when there was an unusual prevalence of small-pox in Calcutta. The total number vaccinated during the year 1895 amounted to 54,982. Of these 15,184 were cases of primary vaccination and 39,798 of re-vaccination. The corresponding figures of the previous year were 10,638 and 10,398, respectively. This shows an increase of 4,546 primary and 29,400 re-vaccinations. Of the 15,184 primary vaccinations, 13,506 or 88·88 per cent. were successful, 709 or 4·66 per cent. were unsuccessful, and in 969 or 6·31 per cent. of cases the result was not ascertained. In primary vaccinations the rate of success calculated on the ascertained cases was 95·0 per cent. Of the 39,798 re-vaccinations, 4,080 or 10·25 per cent. were successful, 26,384 or 66·29 per cent. were unsuccessful, and in 9,334 or 23·45 per cent., the result was not ascertained. The rate of success on ascertained cases in re-vaccinations was 13·32. Of the total number re-vaccinated, 38,218 were males and 16,764 were females. According to nationality, 9,503 were Christians, 33,068 were Hindus, 12,147 were Muhammadans, and 264 other castes; 5,253 were under one year of age, 10,765 were one year and under six years, and 38,964 were six years and upwards.

Vaccination was systematically carried on in all sections of the town and amalgamated area during the year. In Calcutta both the humanised and animal *virus* was kept up by regular transmission and used all the year round. The demand for animal *virus*, however, is increasing every year. Even the lower classes often prefer the calf lymph, and the Marwarees in some cases have allowed their children to be vaccinated from the calf. The prejudice against the use of calf lymph is gradually dying out. During the hot months, such as May and June, calf lymph deteriorated, and all vaccinations performed proved unsuccessful. Fortunately, there were very few

primary vaccinations required at the time. Virus was imported from Darjeeling and Bombay to replenish the lymph, but without success. The Deputy Superintendent of Vaccination, however, procured humanised lymph from the Inspector of Vaccination of Howrah in capillary tubes and established a *virus* in Calcutta by vaccinating children with it, and the lymph thus obtained was then transferred to calf, the vaccine from which proved successful.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1895-96.

(*Lieutenant-Colonel G. M. J. Moore, C.I.E., President.*)

Drainage.—During the official year Rs. 52,333 have been spent under this head, the principal work being laying a sewer from Thacker Street to DeMellows Road pumping station *viâ* Perambore Barracks Road, thus dispensing with the Picottahs at Angalammen Covil Road, Astabujam Road, and Strachans Road, and effectually removing the sewage which used to stagnate at these places. The question of carrying out a comprehensive scheme for the drainage of the whole town is still under the consideration of the Committee, and a trial sewer is to be laid in Parish Vencatachella Iyer Street in order to ascertain the best method of connecting the house drains with the sewer. No great reduction in the mortality of the town can be expected until a good system of drainage and sewerage has been carried out. Government have been pleased to grant Rs. 3,50,000 towards the drainage of Madras and it is hoped that some progress will be made during the next year.

Water-supply.—The Hydraulic Survey of the town referred to in paragraph 185, Section II. of last year's report was completed by the engineer. A sum of Rs. 474,498 has been expended on new works and repairs. Two auxiliary mains have been laid from Kilpauk, one through the 6th and 8th Divisions and the other through the 4th and 1st Divisions, whereby the supply in those portions of the town which were very defective has been greatly improved. The supply is still cut off once a week for the purpose of cleaning the masonry shaft, and though the supply has been considerably improved as regards the quantity, no steps have yet been taken to improve the quality. The analysis of water is anything but satisfactory.

Vaccination.

During the year 1895–96 the total number of cases vaccinated was 27,024 against 24,725 in 1894–95 showing an increase of 2,299 cases. The increase was due to the large number of re-vaccinations performed on adults employed in the various office establishments, firms, &c., in consequence of the prevalence of small-pox in the city in the latter part of the year under report. Out of 27,024 cases vaccinated 16,080 were males and 10,944 females. 25,108 were successful, 804 unsuccessful, and 1,112 unknown. The unsuccessful and unknown results were greater than in 1894–95 by 316 and 184 respectively. The former was due to the large number of re-vaccinations and the latter to convicts. Civil prisoners of the Debtor's Jail, emigrant coolies, &c., having been released before the result of the operation could be ascertained. During the year 1895–96, 2,016 cases voluntarily resorted to the depôts for inspection of the result of the operation. The vaccinators of the respective divisions verified 20,945 cases under Byelaw 11, and issued "successful certificates" to the parents and guardians. These results were again inspected by the Deputy Inspector and four Assistant Deputy Inspectors. The results of vaccination among the convicts of the Penitentiary, civil prisoners of the Debtor's Jail, the emigrant coolies of the Natal and Mauritius Depôts were examined by the Deputy Inspector. More than 50 per cent. of the total number of cases vaccinated were examined by these officers.

The accompanying statement shows the number of cases vaccinated during 1895–96 as compared with 1894–95. As usual calves were sent out to the Natal Emigration Depôt and 2,193 coolies were re-vaccinated against 2,165 in 1894–95. Calves were also sent to the Penitentiary thrice a week to vaccinate the convicts undergoing short terms of imprisonment of from three to five days. The civil prisoners of the Debtor's Jail were sent to the Monegar Choultry Vaccine Depôt and the coolies of the Mauritius Depôt to the Tondiarpet Vaccine Depôt. The number of cases vaccinated in the Penitentiary during 1895–96 was 1,948 against 1,887 in 1894–95. Under the provisions of the Jail Code every convict was hitherto vaccinated on admission, but this rule has been modified during the year thus, "provided that prisoners "who on admission show clear marks of recent successful vaccination need not "be re-vaccinated. Thus, prisoners who have been successfully vaccinated while

" temporarily detained in sub-jails need not be re-vaccinated on admission to Central " and District Jails."

Year.	Total vaccinated.	Compared with the preceding Year.		Successfully vaccinated.	Percentage of success, excluding the unknown cases.
		Increase.	Decrease.		
1894-95 - -	24,725	1,081	—	23,309	97·94
1895-96 - -	27,024	2,299	—	25,108	96·89

The percentage of success in primary and re-vaccinations, excluding the unknown cases from the total, was 96·89 against 97·94 in 1894-95, showing a decrease of 1·5 per cent. due to the large number of re-vaccinations performed during the year 1895-96. The tri-weekly vaccination system introduced in the year 1889-90 compares favourably with the daily vaccination performed in the previous years.

During the year there were nine Vaccine Depôts in which vaccination was carried on free of charge. In seven of them work was carried on tri-weekly, in one (Thousand Lights) tri-weekly, and in one (Egmore) weekly. Calves are inoculated in the Central Depôt, Chintadripet, and sent to the various depôts on working days. During the year, 90 inoculated calves and 391 tubes of lymph were sent on applications to vaccinate persons in private houses. 149 calves were sent to the Penitentiary to vaccinate the convicts, and 44 calves to the Natal Emigration Depôt to vaccinate the coolies.

Out of 27,024 cases vaccinated 2,122 were Europeans, East Indians and Native Christians, 2,464 Muhammadans, 22,298 Hindus and 140 other castes. Out of a total of 27,024 cases operated on 18,877 were primary vaccinations, showing a decrease of 534 cases when compared with the previous year. Of the primary vaccinations, 18,598, or 99·66 per cent. were successful, showing a slight increase of ·3 per cent. over the year 1894-95. There were 8,147 cases of re-vaccination performed on adults with 89·76 per cent. of success against 5,314 with 91·0 in 1894-95, showing a fall of 1·24 per cent. though there was an increase of 2,833 operations.

The number of infants vaccinated during the year was 13,187 against 13,414 in 1894-95, showing a small decrease of 227 cases. Of these, 13,027, or 99·74, were successful. The following table shows the number of cases vaccinated during the past three years under different ages. Out of 27,024 cases 13,187 were infants under one year, 5,019 were above one and under six years, and 8,818 cases above six years :—

	Total Number Vaccinated.			Ratio per Cent. of the Total Number Vaccinated.		
	1893-94.	1894-95.	1895-96.	1893-94.	1894-95.	1895-96.
Under one year - - -	13,343	13,414	13,187	56·4	54·3	48·8
Above one and under six years -	5,021	5,420	5,019	21·3	21·9	18·6
Above six years - - -	5,280	5,891	8,818	22·3	23·8	32·6
Total - - -	23,644	24,725	27,024	100·0	100·0	100·0

Vital statistics.

Births.—During the year 1895 the total number of births registered was 19,137, exclusive of still-births, being 2,075 more than in the previous year, and the highest number recorded in the decennium. The increase in births took place in the second half of the year and was due to food having become appreciably cheaper during the year 1894 and remaining more or less stationery during the year under report. Of these births, 9,767 were males and 9,370 females, the proportion being 104·2 to 100. The number of still-births was 513 against 541 in the previous year. Of these 276 were males and 237 females, the proportion being 116·4 to 100.

The Muhammadans were the most prolific, their birth-rate being 45·1, which shows an increase on previous years. The Hindus came second with a ratio of 42·2, and the Christians third with 39·1. An increase of birth-rate took place amongst all the castes.

Mortality.—The deaths registered during the year numbered 17,052 against 16,542 in 1894, being in the proportion of 37·6 per 1,000 against 36·5 last year, the mean of

the decade being 38·7. The slight increase in the death-rate was partly due to the increase in birth-rate. The ratio in Calcutta for the year under report was 39·6 per 1,000. The months of August and September showed the highest death-rate, viz., 52·6 and 51·2.

The price of food.—During the year there was not any appreciable change in the price of rice as compared with that of last year. Ragi, however, was much cheaper than it was in the previous year.

Mortality from different diseases.—A comparison of the relative mortality from different diseases in 1894 and 1895 shows that the deaths registered under small-pox were fewer in the year under review, and those under all other diseases were more numerous. The death-rate from fevers was above the decennial average, all the others being below. The mortality from small-pox was the lowest except in 1886, when only one death occurred.

Statement of Mortality from the Prevalent Diseases in 1895 *contrasted with that of* 1894.

Years.	Small-pox.	Measles.	Fevers.	Dysentery and Diarrhœa.	Cholera.	Total.	Other Causes.	General Total.	Ratio per 1,000.
1894 - - -	12	190	6,128	2,392	77	8,799	7,743	16,542	36·5
1895 - -	3	249	6,265	2,204	122	8,843	8,209	17,052	37·6
Average for 10 previous years.	32·4	387·0	5,002·0	3,020·0	481·8	8,923·2	8,608·4	17,531·6	38·7

Out of a total mortality of 17,052, 8,509 were males and 8,543 females, giving the proportion of 99·6 to 100. If the death-rates are compared with those of the previous year, it will be found that the increase in the rate among Muhammadans was greatest, the Christians coming next and the Hindus being last. The increase in the death-rate was 2·8, 2·4, and ·8 per 1,000 respectively. The number of deaths according to caste for the year was Hindus, 13,615, Muhammadans, 2,150, Christians, 1,284, the ratios per 1,000 being 37·9, 40·4, and 32·3.

Small-pox.—During the year 1895 the number of deaths from this disease was 3, being the smallest on record except in 1886, when only one death occurred. All three were hospital cases, the residence of two being given as Black Town and the other unknown. All were males and were above the age of 20; this result is due to the excellent work done by the staff of the Vaccination Department.

Cholera.—During the year 122 deaths from cholera occurred against 77 in the previous year. Eighty-two deaths were registered during the first quarter; of these 68 occurred in January. The increase in the number of deaths over the previous quarter was owing to the outbreak of cholera in the Government Lunatic Asylum at the close of the previous quarter, and to the occurrence of some fresh cases in and near Perambore Cheklipalliam. In the 2nd quarter there were three deaths against two in the corresponding quarter of the previous year. The outbreak in the 3rd quarter commenced in the week ending the 28th June. There were 48 attacks and 36 deaths against none in the corresponding quarter of the previous year. Of these 14 deaths occurred in the 1st Division and 10 in the 3rd. In the 4th quarter there was only one death against 40 in the corresponding quarter of the previous year, the decennial average being 111·3.

Measles.—The deaths registered under measles numbered 249 against 190 in 1894, the average for the ten previous years being 387. The 5th, 7th, and 1st Divisions returned the largest number of deaths.

Fevers.—The deaths from fevers numbered 6,265 or 13·8 per 1,000, against 6,128 or 13·5 per 1,000 in the preceding year. The mortality was highest in the 1st Division, Centre Ward, which had a ratio of 19·4 per 1,000, and lowest in 8th Division, South Ward, being 6·7 per 1,000. Taking the divisions into consideration the highest mortality was in the 3rd Division, the ratio being 16·2 per 1,000, the 1st Division coming second with 16·1, and the 2nd Division coming next with 16. The largest number of deaths occurred in August and September, being 696 and 769 respectively, and the smallest in February, being 374.

Bowel complaints.—The deaths from dysentery and diarrhœa numbered 2,204, against 2,392 in the preceding year, being 1,536 from the former and 668 from the latter, which give the ratios 3·3 and 1·4 per 1,000 respectively, or 4·7 from the two together. Dysentery was most severe in the 1st Division, Centre Ward, and diarrhœa in 6th Division, South Ward.

ABSTRACT OF REPORT OF THE ACTING MUNICIPAL COMMISSIONER OF THE CITY OF BOMBAY FOR 1895-96.

(*Mr. P. C. H. Snow.*)

Public works.

SPECIAL DRAINAGE.—For the purpose of carrying out the various large schemes of special drainage required in the city, Mr. James W. Smith, M.I.C.E., the Drainage Engineer of the Municipality of Bombay, was appointed to be in charge of these works under the designation of Special Drainage Engineer, with effect from the 1st March 1893, and continued to hold that office throughout the year under report.

The unfinished works in progress, and the new works sanctioned or commenced during the year, were as follows:—

Colaba Sewerage Works.
Umarkhadi Sewerage Works.
Connaught Road and Sussex Road Drainage and Sewerage Works.
Parel Sewerage Works.
Mazagon Sewerage Works.
Malabar Hill and Khambala Hill Sewerage Works.
Fergusson Road and Chinchpokli Sewerage Works (gravitation portion).
Old Race Course Sewerage Works (gravitation portion).

Colaba Sewerage Works.—The original grant sanctioned for these works was Rs. 7,09,608, but, in addition thereto, the sum of Rs. 50,000 was sanctioned by the Corporation, bringing the total grant up to Rs, 7,59,608. At the close of the year the several payments made amounted to Rs. 7,53,198. The works are being constructed on the Shone system, which is composed of the application of two forces, one resulting from the compression of atmospheric air and the other the natural force of gravity.

Umarkhadi Sewerage Works.—The contractors for this part of the general scheme having withdrawn under notice from the work, it was carried on departmentally until stopped by the S.W. monsoon of 1895. Subsequently it was considered desirable to complete the work by contract. Tenders were therefore invited and work commenced on the 6th November. The total expenditure on the Umarkhadi Works up to the end of the year was Rs. 2,14,682.

Connaught Road and Sussex Road Drainage and Sewerage Works.—This work, so far as the contractors were concerned, is finished and paid for, but some portions yet remain, the completion of which cannot be effected until certain houses which will carry the vent-shafts have been built, and water can be laid on to the flushing tanks by a main.

Parel Sewerage Works (gravitation portion).—The contractors for these works did not complete them within the contracted period of six months, which expired on the 31st May 1895, but they were practically finished at the end of December. The final bill, however, cannot be passed until certain defects are remedied. The estimated cost of the work was Rs. 70,974, and the total expenditure at the close of the year was Rs. 58,127.

Mazagon Sewerage Works (gravitation portion).—The Corporation sanctioned the execution of these works at an estimated cost of Rs. 3,32,661. Tenders were accordingly invited and three were received. The work was commenced on the 23rd November 1895. The contract has to be completed in two years from that date. The total expenditure passed up to the end of the year was Rs. 46,479.

Malabar Hill and Khamballa Hill Sewerage Works (gravitation portion).—Sanction of the Corporation was accorded to carrying out this work at a cost of Rs. 1,57,026: Work was commenced on the 30th November 1895. The contract time for completion is 18 months. The expenditure passed up to the close of the year was Rs. 34,219.

Fergusson Road and Chinchpokli Sewerage Works (gravitation portion).—The total cost of this work is estimated at Rs. 93,572, but as the monsoon was approaching the work was allowed to stand over until the fine weather. No tenders had been invited at the close of the year.

Old Race Course Sewerage Works (gravitation portion).—The commencement of this work, sanctioned at a cost of Rs. 40,815, was also postponed until the fair season.

DRAINAGE.—*Pumping Station, Love Grove, Worli.*—The Worthington triple expansion pumping engines continue to give satisfaction, the average efficiency being 94 per cent. for the year. The whole of the plant was taken over from the makers in the month of May 1895, the last instalment of 2,396*l.* paid, and all claims were finally disposed of. Breakages of parts of the machinery occur occasionally, but the efficiency of the station is not interfered with, as three engines being sufficient for pumping purposes the fourth is always ready for use when wanted.

Colaba Air-compressor Station (Shone System).—The air-compressing machinery of the station consists of three compound non-condensing horizontal steam engines with air-compressing cylinders and a suitable receiver for containing the compressed air, steam being supplied by two steam boilers of the marine type, working up to a pressure of 120 lbs. per square inch. There are five ejector stations situated below the ground at different parts of Colaba, and in each station are two ejectors which, being actuated by the compressed air conveyed from the compressor station through pipes, cause the sewage to be propelled along suitable closed channels to its destination. The ejectors are automatic in their action. The work at the compressor station was practically completed in the beginning of July 1895, and the official trials proving satisfactory the plant was taken over on that date, and on the 22nd of August the station was formally opened, but regular work was not commenced until the 12th of December, since which date the system has worked satisfactorily. As only a few drainage connections have yet been made, the cost of raising sewage by this system has not yet been ascertained.

House Connections.—The Municipal Corporation, under their No. 12429, resolved, on the 29th January 1896, that "having had a favourable experience of the operation " of its resolution of 3rd November 1882, extending over a period of 13 (thirteen) " years, and having applied the principle embraced in the resolution to various " districts of the city with satisfactory results, and finding that the principle is in " complete accordance with the wishes of all the persons concerned, the Corporation still " adheres to that resolution, including in its scope all houses and outhouses, and all " new houses which were formerly excluded, and is now of opinion that the terms of " the resolution of the 3rd November 1882 as now amended should be made applicable, " in the future, to all the districts of the City." An advance of one lakh of rupees was provided and the house connection work of all new houses completed was undertaken, together with repairs to the connections of houses already connected by the municipality, and was carried out up to the end of the year. No expenditure on this account was debited to the above grant of rupees one lakh up to the 31st March 1896, as the expenses were incurred in March 1896.

The report of the House Connections Committee was submitted to the Corporation on the 10th December 1894, and the Corporation, at their meeting held on the 6th May 1895, resolved "that, in carrying out house connections in future the " Corporation trust that the recommendations of the Committee will be carefully " considered."

Waterworks, Tansa Lake.—The rainfall for the year 1895 was 92·37 inches. The heaviest rainfall in one day occurred on the 20th June 1895, when 5·34 inches were registered. The lowest water level was 394·85 T.H.D. on the 18th June. The lake overflowed on the 18th July after 31·59 inches of rain had been registered, and ceased to do so on the 3rd October. The quantity of water which passed over the waste-water weir is estimated at 18,735 millions gallons. The approximate quantity of water drawn off into the duct of the lake was 8,780,844,233 gallons throughout the year, of which quantity about 88 millions of gallons were passed into the Vehar Lake, the remainder being sent forward to the city. The building of inspector's quarters at Kaling, sanctioned by the Corporation at an estimated cost of Rs. 3,932, was in progress at the end of the year. The erection of chawls at the lake, at an estimated cost of Rs. 12,000, was also in hand at the close of the year. The supply of water from Tansa was shut off from the 30th November to 7th December to allow of the general inspection and repair of the duct. Two bursts of the 41 inches main occurred, but were soon repaired, the stoppage of water through this cause lasting only for a period of two days and 23½ hours. The second portion of the work of repairing and strengthening the Kasheli embankment was in progress at the end of the year. The grant for the whole of this work was Rs. 30,000. The expenditure on the part previously done, inclusive of that in progress, was Rs. 26,212.

Vehar Lake.—The rainfall for 1895 was 82·81 inches, being 2·75 inches less than in 1894, and 1·09 inches less than the average, which is 83·90 inches. The lake over-

flowed on the 12th August, and ceased on the 26th September. The heaviest rainfall in one day was 8·30 inches on the 8th September. The lowest water level was 253·70 T.H.D. on the 14th June. The storage on the 31st October 1894 was 11,335 millions of gallons, and on the 31st October 1895 was 11,010 millions of gallons. The daily loss during the dry season from 31st October 1894 to 31st May 1895 was 14·3 millions of gallons per day, in addition to that drawn from Tansa Lake. The estimated quantity of water received into the Vehar Lake from the Tansa Duct between the 31st October 1894 and the 31st May 1895 was 82·5 millions of gallons. Between the 8th August and 17th September 1895, 581 millions of gallons were received from the Tulsi Lake by overflow. The quantity of water that passed over the Vehar waste weir between the 12th August and the 26th September was estimated at 4,191 millions of gallons; a joint leak occurred at Chinchpookly, and a burst on the Suparibaug Road.

Tulsi Lake—The rainfall for the year 1895 was 100·40 inches. The heaviest fall in one day was 8·08 inches on the 8th September. The lowest water level was 439·50 T.H.D. on the 14th June. The lake overflowed on the 8th August, and ceased to do so on the 17th September 1895. The storage on the 31st October 1894 was 2,243 millions of gallons, and on the 31st October 1895 it was 2,136 millions of gallons. The loss during the dry season from 1st November 1895 to the 31st March 1896 was 880 millions of gallons. The quantity of water which passed over the waste weir into the Vehar Valley is estimated at 581 millions of gallons.

Pawai Lake.—The water-supply from this lake was not required throughout the year. The pumping plant was transferred from the water branch to the Assistant Executive Engineer, Mechanical Branch, with all accessories thereto, on the 29th January 1896. After protracted proceedings in the Thana District Court and the Bombay High Court, the purchase-money for the land acquired for the Pawai works, amounting to the total of Rs. 1,67,904, was paid into Court.

Malabar Hill Reservoir.—The Corporation, as per their Resolution No. 12569 of 30th January 1896, sanctioned certain structural alterations to the filters at the Malabar Hill Reservoir at a cost of Rs. 14,400, and the work was in progress at the close of the year.

Bhandarwada Reservoir.—The filters have worked satisfactorily throughout the year. The covering of the clear water channel has answered its purpose. The parapet wall between the filters and distributing basin was raised at a cost of Rs. 434; this was to prevent the filtered water being fouled by washings from the garden over the distributing basin. The work of covering the storage basin was proceeded with throughout the year, but was not completed at the close of the year. The original grant for this work was Rs. 1,60,097, but the revised estimate shows that it may be completed for Rs. 1,47,000, whereby a saving may be realised of Rs. 13,097. The filling up of filter No. 9 with filtering materials was commenced, and photographs were taken at intervals of about three months, to show the progress and character of the work.

During the year the offers of reward for the capture of crocodiles in the lakes, and the finding of their eggs, resulted in claims for 7 crocodiles and 91 eggs. There was one reported case of leeches being ejected from the service tap of a house in the Fort. This being traced, was found to be most likely due to a broken service pipe near a drain in which many leeches were found.

Distribution and Maintenance.—The number of bursts of water mains throughout the year was 255, against 313 during last year. During the year 522 new connections were made, and 243 services disconnected on account of buildings demolished, non-payment of rates, or for infringements of the provisions of the Municipal Act. The net increase in the number of connections was 279, bringing the total up to 19,455, and showing an increase of 1·4 per cent. The meters in use on the 31st March 1896 numbered 1,854, being an increase of 180 over the previous year. The registered consumption, as per meter, throughout the year, was 1,290,500,000 gallons. The night reading work to check waste has been considerably increased owing to disturbance of sub-soil for drainage work.

Public health.

The state of the public health during the year under review showed a great improvement over that of the previous year, there being a decrease in the mortality of 2,249. The total number of deaths from all causes amounted to 25,081, equal to a death-rate of 30·52 per 1,000 of population calculated on a population of 821,764 (census of 1891). The average number of deaths for the previous five years amounted to 25,183, or a death-rate of 30·64 per 1,000 of population. The mortality returns show a decrease in almost all the usual causes of death.

The number of deaths according to place of birth was as follows :—

Born in Bombay - - - -	11,584
Born elsewhere and unknown - - -	13,497
Total - - -	25,081

The sections of highest mortality were 2nd Nagpada 50·61, Kamatipura 44·85, Tardeo 40·62, Khara Talao 39·24, Oomarkhadi 36·51, Chukla 36·49, Byculla 36·11, Girgaum 35·85, and the sections of lowest mortality were the Water Division 3·02, Fort Southern 8·60, Esplanade 12·51, Chowpati 14·76, Walkeshwar 16·32, and Mahalakshmi 18·39, per 1,000 of population. The death-rate was highest amongst Negro-Africans, Lingaets, Hindu low caste, Jains, Mussulman, Bhatias and Eurasians, being 541·09, 65·05, 47·22, 45·15, 39·30, 38·27, and 35·56 per 1,000 of population respectively, and lowest amongst Europeans, Parsees, Jews, Native Christians, and Brahmins, being 20·81, 22·94, 23·70, 25·51, and 25·72 per 1,000 of population respectively.

Cholera.—The number of deaths from cholera was 90, or 336 less than in the last year, and 112 below the average. The sections of greatest mortality were Parel, Mahim, Tardeo, Mahalakshmi, Tarwadi, Byculla, and Mandvie. The highest mortality by class was amongst Eurasians, Hindu low caste, Hindus of other castes, Bhatias, and Native Christians.

Small-pox.—The deaths from small-pox were 270, or 261 below the total of the previous year, and 36 less than the average. They occurred chiefly amongst the Negro-Africans, Lingaets, Native Christians, Brahmins, and Jains. The mortality was highest in Girgaum, Fanaswadi, Middle and Lower Colaba, Dhobi Talao, Parel, and Mazagon.

Measles.—There were 544 deaths from measles, or 243 less than in the previous year, and 28 more than the average. Of these, 423 occurred in the first three years of life. The highest mortality occurred amongst Lingaets, Hindu low caste, Jews, and Eurasians. The death-rate was highest in the districts of Dongri, Girgaum, Kamatipura, Oomarkhari, and Tardeo.

Fever.—There were 6,404 deaths from fevers, or 54 less than in the previous year, and 272 less than the average. The death-rate was highest in the districts of Sewri, Khara Talao, Mandvi, Chukla, Girgaum, Mazagon, and Dongri. The greatest mortality was amongst Negro-Africans, Lingaets, Jains, Bhatias, Hindu low caste and Brahmins.

Leprosy.—There were 42 deaths from Leprosy, or 9 less than in the previous year, and 17 below the average.

Births.—The number of births registered, exclusive of still-born, was 15,684, or 626 more than in the previous year. Of these, 8,150 were males and 7,534 females. Excluding Negro-Africans, the birth-rate was highest amongst Hindu low caste, Jews, Parsees, Lingaets, and Eurasians. The sections giving the highest birth-rate were Mahim, Parel, Tardeo, Kamatipura, Chukla, and Sion.

Conservancy.—On an average 4,419·4 men and women and 1,092·51 scavengering and drain carts, and 205 night-soil and cess-pool carts were at work each day. 322,656·69 tons of garbage, equal to 883·99 tons a day, was collected and removed and disposed of, against 321,991·91 tons in 1894. 149,670·62 tons of night-soil equal to 410·05 tons a day, was collected and removed, against 150,004·24 in 1894. 179·6 miles of covered drains were opened and cleaned, against 182·3 in 1894. There were 5 horses and 2,231 bullocks owned by the Municipality, and of these 2 horses and 199 bullocks died and 40 were cast off and sent to the Pinjrapole.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1896.

(Surgeon-Lieutenant-Colonel T. S. Weir.)

Although there has been a very great improvement in the public health this year, the mortality being 2,249 less than in the last year, yet I cannot hope for further reduction in the mortality until the local insanitary causes that I have so frequently described, and which I will once more describe so that there may be no responsibility on me, are removed. 25,081 deaths were registered, being 2,249 less than in 1894. Of this reduction in mortality 820 deaths were from diseases of the respiratory system, 594 from diseases of the digestive system, 336 from cholera, 261 from small-pox, 243 from measles, and 54 from fevers.

The two previous years 1893 and 1894 were remarkable from the meteorological phenomena observed and the incidence of diseases recorded, not only amongst human beings, but amongst animals. The abnormal meteorological features of these two years were accompanied by the prevalence of zymotic diseases amongst human beings and animals.

I have in former reports again and again demonstrated that epidemic states amongst animals or human beings in the city have always been synchronous with epidemic conditions and influences in the country around. The experience of this year is a further confirmation of the accuracy of this opinion.

In the report for 1893 I wrote as follows :—"I have after the very unfavourable "record of 1892 to report in this year a very great improvement in the public health, "the mortality being 3,376 less than in that year, but only 197 less than the "average. This is so far satisfactory, but it will not and cannot continue unless "that more effective means for carrying away the water brought into the city are "constructed."

Although in 1895 there have been 2,249 fewer deaths than in 1894, I must repeat again what I wrote in 1893, that this improvement in the public health, so far as represented by 2,249 deaths, will not and cannot continue unless that more general and therefore more effective means are constructed for carrying away the water brought into the city. It is true that the reduction in mortality over the previous year indicates that the general health of the city was so much better, but it does not indicate, when the figures are carefully examined, that the local causes of disease have been proportionately removed. The reduction is chiefly due to a lower mortality from diseases whose prevalence I have always contended was due, not to local conditions, but to general seasonal influences, although the mortality from each type of disease was influenced and intensified by local conditions. The reduction in mortality due to fevers is not considerable, being 54 less than in the last year and 273 below the average. The chief reduction has been caused through a diminished mortality from cholera, small-pox, and measles, or, in other words, the three chief zymotic causes and the groups of diseases which accompany or are synchronous with them. I will now briefly discuss the local causes unfavourably influencing the public health, and in doing so I am merely repeating the remarks made in previous reports, and more especially in the Quarterly Reports of the last year, and in the last Annual Report. The causes are :—

I. Insufficient drainage—
   - *a.* Sewage.
   - *b.* Subsoil water.
   - *c.* Absence of connections between building and sewers.

II. Over-crowding.

III. Disposal of all the dry refuse on the flats.

IV. The imperfect provision in the Municipal Act in regard to—
   - *a.* Rebuilding of houses on old foundations without a space for ventilation and drainage being left on one side.
   - *b.* The exclusion of the evidence of municipal officers in regard to nuisances.

V. The obstruction of the sea-currents around the Island by the embankments at Bandora and Coorla.

The unequal equilibrium between the water coming into the island and the liquid sewage pumped out is the most serious and urgent condition affecting the public health to be given attention to.

There has been an enormous increase of the water supply since 1892, from 16½ million gallons to some 29 million gallons or more daily, and very little increase in the number of drains. The island is flooded or irrigated with water, and unless drains are constructed to take away all the water that comes into the city, the life of a healthy population will not be possible; what has been seen in countries of marsh and wet, the poisoning of life from malarial fevers, will be seen here. It is not possible to look to the future except with anxiety. With incomplete drainage, there has been an enormous quantity of water left in the ground, some five or more million gallons of water daily, which the pumping power has been unable to remove, a floating balance indicating danger; and there must be, however powerful and perfect the pumping power may be, an enormous quantity of water which will not flow away and which cannot flow to, nor be carried by, the tributary drains of the out-fall sewer, till drainage channels are constructed, because in more than half the island there are not drains. I hope much in the future from the new and powerful pumps and the increased pumping power which it is known they give, but drains must be constructed in the districts undrained to carry the water and sewage to the tributaries of the pumps, if the greater power in pumping is to have any general effect in reducing the balance of water now unremoved in the island. However powerful the pumps may be, there must be drains in the districts which now have not drains, if the pumps are to remove the water and the drainage from these districts. The first principle for the preservation of public health is this, that the water coming into the city shall be taken away and not left in the soil, and this first principle has been neglected so far in Bombay. Even the water currents round the island have been obstructed by the causeways and embankments at Bandora and Coorla. The estuary between Bombay, Bandora, and Coorla is silting up. The most offensive trades, the tanneries, discharge into the estuary, and the water at low tide is fœtid.

The obstruction of the sea-currents around the island by the embankments at Bandora and Coorla or elsewhere is, next to insufficient drainage on land, the most serious condition affecting generally the island. An additional water-way ought to be opened on the south side of the Dharavie Creek so as to establish a current on the south to scour away the drainage from the tanneries. To those who take an interest in the public health few questions can be of more interest than the state of the subsoil water of the island.

There is no doubt the questions of first importance to the health of this city are: (i) the completion of the drainage of the city, and (ii) the prevention of waste of water. The drainage operations have given us an opportunity that we had not before of observing the distribution of the subsoil water. If anyone had a doubt as to the saturation of the subsoil and as to the rapidity with which the subsoil water, in some portions of the island, rises and falls, an inspection of some of the drainage excavations near Colaba would dispel that doubt. The rapidity with which the subsoil water rises in portions of Colaba, is the most extraordinary phenomenon that can be observed in this island; it is a phenomenon which can be observed with the eyes, for in some of the excavations as soon as the subsoil water has been pumped out, fresh subsoil water can be seen welling up. It seems as if the tidal currents flow across under the land, and the loose nature of the artificial soil of portions of Colaba which have been reclaimed favour the circulation of the currents. The drainage works have also given us an opportunity of studying the distribution of the subsoil water in other portions of the island as, for instance, on the north side of the Marine Lines, where some 1,008,000 gallons of subsoil water were pumped out between the 5th and 25th February 1896. In Oomerkharee I observed a curious and interesting phenomenon showing how in rocky formations houses may be damp on the sides of the drainage excavations. Between the rock formation and the road metal there seemed to be a reservoir of subsoil water which kept escaping into the excavations. The drainage works in one portion of the city, near the Cawasji Patel Tank, have also come down to what can only be described as an underground stream. It has to be remembered that the position where this stream has been struck is near Howdachi Wadi, from wells in which, at one period, a portion of the water-supply of Bombay used to be pumped up to the two tanks. An enormous quantity of water has been pumped up from this excavation and the stream seems as free as ever. My impression is that the excavation there has struck the subsoil stream that fed the Baboola tank and the wells in Howdachi Wadi, for there has been this year a very remarkable subsidence in the

level of the water in the Babula tank. The water in this tank has never been so low before; even when, many years ago, the municipality attempted to clean the tank out, it was not possible to pump the water to as low a level as it has fallen this year. The low level of the water disclosed two large streams of subsoil water entering the tank from the south. I may mention that on a former occasion when it was attempted to clean the Babula tank out, the most serious nuisances were caused, nuisances accompanied by a great prevalence of fevers in the J. J. Hospital. Before any tank is filled in, I think it should be insisted on as an essential condition that a certificate should be obtained from the executive engineer that the subsoil drainage of the locality in which the tank may be will remove quickly all the subsoil water flowing into the tank. Until drainage works are sufficiently advanced to remove the water which collects in the tanks of a locality, tanks ought not to be filled in. We have had an illustration of this in Khandia Tank Street. A large tank was filled in, and the result has been that the subsoil water of the street at high states of the tide rises up through the metal of the road.

In former reports I have referred to the waste of water, and the apprehensions I entertained of the effects of waste as seen in damp ground inside and outside buildings were not shared by some others, but I imagine that no one has now any doubts as to the reality of that waste and the evil effects which come of it. The measures taken to prevent waste, and the attention given to water pipes during the last year, have undoubtedly been beneficial and have had the effect of reducing the ill consequences of water running to waste. In one case in which waste of water had been carefully gauged by the Water Department, the Water Engineer wrote in reference to it: "I caused a meter to be fixed, with the result that the consumption "is found to be over 3,000 gallons per day. This works out to a payment of less "than ½ anna per 1,000 gallons. Taking the out-force of water at 3 annas per 1,000, "the payment should be over Rs. 2,000 per year, instead of about Rs. 350 as now "paid. The consumption per head is over 20 gallons against a desirable and efficient "allowance of six for such purposes as it is here used for." This, be it remembered, is waste of water at a group of buildings very imperfectly drained, and in consequence very damp.

It has occurred to me that at all chawls the water-pipes should be so placed that the water running to waste would flush the drains.

A very interesting correspondence has taken place on a letter from me suggesting that the scrub and long grass on the gathering grounds of the lakes Tansa, Vehar, and Tulsi should be cut down and burnt before the annual season of rainfall in the monsoon. During an inspection of the Tansa Lake in the last hot weather, I observed a quantity of long grass and scrub, more or less dead, just above the lake, and it seemed to me that the grass must soon rot and be washed down into the lake. The Forest Officer to whom the question was referred for opinion disapproved of the burning of the grass and scrub because of the denudation that, in his opinion, it would lead to. He wrote:—"The tree growth must also in due course disappear, and "the soil, having no protection, will be washed down the slopes into the lake and silt "it up; while, in the meantime, the leaves of the trees (which are now retained in "the grass and gradually incorporated in the soil, forming the mould so necessary "for plant life) will be blown or washed into the lake, and till all the trees were dead "the water of the lake would probably be worse than it can possibly be at present."

The question at first sight appears to be—"Will burning of the grass cause "denudation of the soil?"—that, however, is not the real question. The real point is this:—"Will burning of the grass as proposed by me cause denudation of the soil?" The Forest Officer has had, I think, in mind the burning of the soil and the turning up of it afterwards for agriculture. That is a totally different operation, I maintain. Last year, at Lanowli, I watched carefully the effect of burning the grass of a hill-slope, and I observed that the burning had not, after the rain came, the effect of denuding the soil. On the first moisture the tender shoots of grass came up and bound the earth firmly. The serious question is this: Is the preservation or conservation of all the grass and all the rubbish in the forests around the lakes compatible with the conservancy of the lakes and a pure supply of water. Clearly our policy ought to be to prevent all the impurities we can prevent descending into the lakes rather than to let the impurities in and have afterwards to adopt measures to intercept or destroy them. The preservation of forest means the preservation of mould, and with forest mould, some of which must be washed into the lakes, come forest fevers.

Towards the end of the year I had a correspondence with the G. I. P. Railway in regard to the importation of cases of cholera from Pandharpoor. Four cases within

two days were taken out of the train ill, two at Dadar, and the other two from other stations on the line. I wrote to the railway company inquiring whether any special precautions were taken for the examination of passengers coming from Pandharpoor. I was informed in reply "that at Dhond and Mammar the company's apothecary was "present on the platform for all trains conveying pilgrims.

"Special precautions were also taken at Barsi Road, and I am informed that only one female passenger showing symptoms of cholera was detected and prevented from travelling.

"In the village the district police were on the alert to prevent sick people from entering the railway premises.

"The cholera house was open and in charge of a Hospital Assistant, and it is stated that 19 cases were traced between the 30th October and 5th instant, and 11 deaths occurred.

"It is possible with such a rush of passengers for cases in the early stages to escape."

The subtleties that the Municipal Law encourages cannot be better illustrated than by the following case:—We have the power, under section 257, to call on a person to pave a sweepers' passage, and if the passage is not paved and the law complied with, there are certain penalties imposed for neglecting to comply with the law, but the passage must be a sweepers' passage and no other kind of passage. Let us take another passage between houses on which slops are thrown and which is in a constant state of soddenness, and, therefore, a danger to the buildings whose foundations are polluted through the water thrown on this passage. In this case we can do nothing because the passage is not a sweepers' passage. This is almost absurd, and it is certainly trifling with the public health and the public comfort.

It is deplorable that houses in the most crowded portions of the city can be rebuilt without leaving on one side an open space for ventilation and drainage. It seems of little avail having Building Byelaws when people can build houses where houses are closest together without leaving on one side a gully for open air, for light, and for drainage. Public attention is affected by the loss of life, however small, when a building falls, but here we have, through imperfection in the Municipal Law, many people annually poisoned by foul air. We have had cases of rapid poisoning through the foul air of sewers, men suddenly suffocated by mephitic vapours, and the cases have been the subject of prolonged legal inquiry, but here, in the case of buildings without a gully on one side, we have, although slower, not less certain, poisoning protected or tolerated by the law.

I have before referred to the dangerous positions in which water-closets have been constructed inside buildings. I have lately seen some plans on which it was proposed to construct water-closets near not only wells but alongside cook-rooms, and further this dangerous proposal could not be prevented. In many old buildings in the most crowded parts of the city the privies are near cook-rooms, and the result is cases of diarrhœa developing into cases of choleraic diarrhœa with the symptoms of cholera. It is a most dangerous position for cook-rooms to be placed in.

I am glad to be able to refer to the resolution of the corporation sanctioning the construction of an open drain where the foul ditch described in former reports flows and the sewage lies in pools on the ground between buildings:—"The drainage from "Parel to the north of Government House, Parel, on the south flows down in ditches "past the church in a wide cesspool to a ditch between buildings—between two rows "of dwellings—and between these buildings occupied by many people the sewage "soaks into the ground. On the north the drainage flows on to the low ground near "the railway station—ground flooded with sewage and wet from the leakage of a "water main."

Such is the ditch! The open drain sanctioned will take the place of the ditch. Money could not be better spent. It is a mistake to suppose that the money will be wasted when a system of drainage has been carried out in this locality. The ditch follows the course of a natural rain-water channel and it carries rain-water, and the same purpose this open drain will serve. The open drain will do harmlessly what the ditch could not do—carry sewage away from dwellings. It will give great relief to the people of the locality, and it was the only means by which speedy relief could have been given.

About a mile and-a-half of open drains will be constructed with open drain connections from the buildings. The sides of the drains will be pitched and embankments formed which may be used for bathing, so that the people, instead of standing in pools of water in front of their dwellings, will be able to stand and walk on dry ground, and where they bathe the ground will not be flooded nor made into a

pool of water and mud. It is true that the sewage will only be carried away from buildings to low-lying ground far from buildings, but to the people living in this locality what comfort these open drains will bring?

I am glad to state that tanks have been sanctioned to collect the waste water where water from stand-pipes was running to waste and washing away footpaths in Parel, to relieve pressure in the water-mains, and the water can now be used for bathing or other purposes.

In one case in which I objected to the position of a water-closet within two feet of a well, the Executive Engineer was of opinion that there is nothing in the Municipal Act under which the Commissioner can fix a particular site or object to a site proposed by a party for a water-closet or a privy. But in Byelaw No. 34, however, such power is given to him for privies only, and the Executive Engineer is, therefore, of opinion that the municipality cannot prevent a man from building his water-closet wherever he chooses to do so. As the question was one of great importance, the opinion of the Municipal Solicitors was asked. The solicitors were of opinion that "the Municipal "Act gives no power to the Commissioner to prescribe the position in which an owner "of property is to place a water-closet which he proposes to build, nor does it contain "any provision which enables the Commissioner to prevent such an owner from "building his water-closet wherever he chooses to do so, provided of course that the "position chosen is not inconsistent with the due observance and fulfiment of the "provisions of section 251. Byelaw No. 34 of the building byelaws does not extend "to, and cannot possibly be held to apply to, water-closets."

Very great anxiety has been caused to me by the number of applications we have received to construct water-closets. A person who has not space for a privy thinks that he is wise in putting a water-closet where he would not be permitted to build a privy. I referred to this in my last annual report, and I have also referred to it in other reports. If the rules proposed by the Committee, consisting of the Executive Engineer, the Special Drainage Engineer, the Drainage Engineer, and the Health Officer, appointed by the Commissioner to consider the system of house-connections for Colaba be adopted and carried out in the city generally, the danger from water-closets will be reduced to a minimum. A curious experience occurred while this Committee was sitting. On one day when I happened to be strongly objecting to the construction of water-closets in bathrooms, information came to us that on that morning in one of the finest buildings in the Fort the sewage had regurgitated back from the street sewer up through the water-closets. We went in consequence and inspected the building and found an abominable nuisance, an odour which may be described as of putrid paints. This led to the inspection of another building not far away, in which there are water-closets, and in this building we observed outside the water-closets of all places a tiffin room for "young ladies."

I am sorry that practically no progress has been made in the works necessary to the making of connexions between sewers, some of which have been constructed as far back as 1880, a list of which I gave in the last annual report, and buildings. The question as to whom the connexions were to be made by, was, however, coming to a final stage of discussion. The question of most urgency, after the construction of drains to carry away sewage and water, is the question of connexions between buildings and sewers. There are sewers on the east end of the Island that have been ready for use for some 16 years to which connexions have not yet been completed. Fortunately, on that side of the Island in the most crowded portions there are old channels, more or less worn away by cleaning and scraping, originally intended for rain-water, by which sewage and rain-water can flow away. But on other sides and in other parts of the Island, there are only ditches, the sides of which have at one time been roughly formed by the Health Department collecting and arranging some stones to form banks between which the sewage might flow, from which most serious nuisances come. Unless that connexions are promptly made, I fear that the position of some of the sewers will be forgotten and that they will, as occurred in Kamathipura many years ago, silt up. There is no question the most careful supervision is necessary, no matter by whom house-connexions are made, and a very large establishment ought to be, and will have to be, employed for supervision. The construction of house connexions in crowded portions of the city is attended by many difficulties. In fact, if house-connexion work is to be thoroughly supervised, it involves an expenditure for supervision which the municipality have little idea of. In the narrow lanes and in gullies in which a man can scarcely turn it is most difficult to supervise the work.

It seems to me that the only immediate remedy for the serious nuisances that now exist in Parel and the suburbs is the construction of a number of intercepting open drains to carry sewage and water away from dwellings.

I am glad that a system of drainage which will embrace the Nagpadas, districts specially referred to in my last annual report, has been sanctioned.

As yet connexions have not been made to the Shone system in Colaba.

I would give an instance in a district now forming a portion of the city of the difficulties which the absence of drains causes. The district is Byculla, and the locality is the important one of Gilder Street, the north portion of which has not a sewer. There are most serious nuisances in the locality around groups of chawls off this street caused by pools of water and sewage. The Health Department prosecuted in order to abate the nuisances and obtained the construction of cesspools. The cesspools, which are masonry tanks, merely embank the sewage during the fair weather. In the wet weather the tanks overflow and sewage and water cover the open ground to the foundations of the buildings. The Drainage Engineer and I made a long inspection of the locality, the time of the year being the rainy season. The ground around the chawls was covered with water. It occurred to the Drainage Engineer that a connexion might be made with the rain-water drain in Gilder Street, but on taking the levels it was found that the storm-water drain was higher than the level of the dwellings, so that a connexion could not be made. This is a very important locality, in which there are, as I have now described them, serious nuisances. Further south of the Bellasis Bridge the same difficulties have occurred owing to, not the absence of drainage, but the low level of the ground. There is a group of buildings in that locality consisting of six chawls, and although they have plinths above the level of the surrounding ground, they are still too low to be connected with the system of drainage in the district. The result is that all the water and sewage has to be used for irrigation around the dwellings.

A great deal of attention has been given during the year to the arrangements for the filtration of the water supply. I strongly advocated the improvement of the ventilation of the chambers in which the filter beds are placed, and improvements have been effected. Still in the hot season the temperature in the filtration chambers is some 5 degrees above the temperature in the shade in the outer air. The water in the reservoirs ought to be kept as cool as possible.

The general death-rate is very unequally distributed; the Water Division having a mortality of 3·02, the Fort, South, 8·60, the Esplanade 12·51, and Chaopati a death-rate of 14·76. At the other extreme we find Second Nagpada with a mortality of 50·61, Kamathipura with a mortality of 44·85, Tardeo with a mortality of 40·51, and Khara Talao with a mortality of 39·24.

The highest mortality has occurred in Second Nagpada. I am glad to be able to record that a system of drainage has been sanctioned for the Nagpadas, and that after many years there is a hope of this district being drained. A system of subsoil drainage will, however, have eventually to be carried out in the Nagpadas. The locality of Kandia Street to which I have referred as exhibiting a remarkable fluctuation and rise in the subsoil drainage up to the road level is in Second Nagpada.

The second highest mortality has occured in Kamathipura. The measures necessary for the improvement of Kamathipura, I have described fully in the following words in the last annual report:—"I have for many years described the insanitary conditions " influencing the health of the people of this locality, and enhancing the mortality of " Kamathipura, and I need not now do more than briefly refer to some of these " conditions. The conditions to which I am now drawing attention are the high level " of the subsoil water and the nature of the soil. In the annual report for 1892–93 I " referred to the mortality in the locality of Kamathipura as follows:—'Although " 'the mortality in Kamathipura is high, it is not the highest as in the last year. There " 'are two improvements which should be carried out in Kamathipura—the drainage of " 'the subsoil water which is almost up to the surface even in the hot season, and the " 'improvement of buildings. A member of the Corporation, who has come to live " 'in the old Kamathipura district, has seen to his amazement the water rising up " 'through the floor of his house. I told him it would be so, and even worse, before the " 'rains were over. Kamathipura is now one of the densely populated localities.'".

Tardeo, the locality of third highest mortality, is very damp, and localities in it are very low lying and made up also of artificial soil. Portions of this district were, many years ago, reclaimed with refuse, traces of which are still found. There is, moreover, a very numerous and poor population in the locality, and, in addition, an increasing number of factory hands.

Umarkhari occupies the fifth place. I am glad that a system of drainage, which will embrace this district, has been sanctioned.

Chukla occupies the sixth place. It is a district of intense crowding, having had as many as 624 persons to an acre in 1891. The houses are also very imperfectly ventilated, being dark and overcrowded. The district has a number of sewers to which connexions have not yet been made. Not only should connexions be made to these sewers and the system of drainage completed, but an open space for which there is great need should be provided in the district.

The mortality under one year of age and under very closely indicates the insanitary conditions and the chances of life in districts. For instance, the five sections in which the highest mortality amongst children under one year of age has occurred, are Tardeo, Second Nagpada, First Nagpada, and Umarkhari. These are all undoubtedly sections of very insanitary conditions, both within and without buildings.

The mortality by class is an indication of the conditions influencing each community and, in consequence, the mortality by class is always of very great interest. Of the four principal classes the mortality, compared with the year before, is very much lower among Mussulman, the reduction of mortality in this community being equal to 2·80 per 1,000, and a little higher amongst Europeans. The mortality of European males is a little lower than in 1894, being 18·72 against 18·97, representing a difference of two deaths. The mortality of European females is 2·21 higher, the excess, I believe, being due to European females when seriously ill coming here either for medical treatment or on their way to some other place for a change.

The mortality amongst Parsees is 1·14 higher than in 1894, but ·84 lower than in 1892. Although the total mortality of Parsees is 1·14 higher than in 1894, the mortality of males is actually lower and the total enhancement is caused by a higher female death-rate. The increase in female mortality, I am inclined to believe, is due to a number of females, when seriously ill, coming to Bombay for medical assistance. But compared with the death-rate in the great mass of the population, the mortality amongst Parsee females is very low.

Excluding the small communities liable to great fluctuation in population, the highest mortality (54·14) has occurred amongst Hindu Low-Caste, although the death-rate is less than in the year before. It has ever been so. The mortality will always remain high amongst Hindu Low-Caste. Whenever the seasons have been unfavourable and disease rife, Hindu Low-Caste have suffered most. They are very poor, living in crowded localities, and in the most insanitary buildings of these localities, several families in one room, a custom unknown in other classes, on damp floors and eating the poorest food. I can only suggest what I suggested in 1885, that the Municipality should build dwellings for them and give medical relief and charity.

In all the chief classes the female mortality is much in excess of the male. There are many influences unfavourably affecting the chances of female life during the child-bearing age: of these, imperfect house ventilation and seclusion of life in ill-ventilated and ill-drained and overcrowded buildings amidst privation or poverty are the most evident, and those to which attention is first directed.

The mortality from the chief death causes is shown in the table following :—

Table showing the Number of Deaths and the Death-rate from Different Causes in 1895.

Causes of Death.	Number of Deaths.	Death-rate per 1,000 of Population.
Small-pox	270	·33
Measles	544	·66
Fevers	6,404	7·79
Cholera	90	·11
Phthisis	3,610	4·39
Diseases of the Nervous System	2,044	2·49
„ „ Respiratory System	4,565	5·56
Diarrhœa	1,188	1·45
Dysentery	625	·76
Accidents	488	·59
All other causes, except Still-born	5,253	6·39
TOTAL	25,081	30·52

The mortality from small-pox, measles, cholera, and fevers in 1894 and 1895 is contrasted in the table following :—

Causes.	1894.	1895.
Small-pox	·6	·33
Measles	·96	·66
Cholera	·52	·11
Fevers	7·86	7·79

It will be observed that there has been a decrease in the mortality from the chief death causes, namely, fevers, small-pox, measles, and cholera equal to 2·73 per 1,000.

The mortality by age periods follows nearly the same incidence as in former years. The mortality of male children of two years of age and under is higher than of females; while from two years of age and upwards the mortality amongst female children commences to rise until in the nubile period it is more than double the male mortality. The causes of this terrible fatality amongst women and young women I have frequently referred to. The high female mortality at this important period of life is one of the most serious influences enhancing the mortality. The terrible loss of female life indicated in these tables may be diminished through medical relief and more prosperous and economic conditions and by better house sanitation. Between 9 and 40 years of age the female mortality is more than double the male. This is a very deplorable loss of life, and it falls heaviest on the following classes, viz.: Jains, Brahmins, Musalman, and Native Christians. The incidence of the female mortality is a great factor in the fluctuation of the death-rate of localities. The localities of highest mortality are the localities with the highest female death-rate. High district mortality indicates a sacrifice of adult female life and a high death-rate of children.

Measles.—The mortality from measles is much less than in the last year; 544 deaths were registered, being 243 less than in 1894, and 28 more than the average. With the lower mortality from small-pox there has also been a decrease in the number of deaths from measles. Of the large communities, the highest mortality has occurred amongst Hindu Low-Caste, then follow Jews, and Eurasians.

Small-pox.—From small-pox 270 deaths were registered, being 261 less than in the last year and 36 less than the average. There is, as I have stated before, a remarkable relation between the incidence of the mortality from both small-pox and measles. Of the large communities, the highest mortality occurred amongst Native Christians and the mass of the Hindu population.

Fevers.—The mortality from fevers is 54 less than in the last year and 272 less than the average. 5,150 of the deaths from fevers were referred to remittent fever, being 140 less than in the last year, and 289 less than the average. Thirty-five were referred to enteric fever, being nine more than in the last year and 15 more than the average. The increase in the mortality from enteric fever must, I think, be ascribed to more cases having been treated by medical men and therefore more accurate registration. The mortality from fevers acquired its highest incidence in the month of May. In the same month in the previous two years the highest mortality from fevers also occurred.

Table showing the Mortality from Fevers according to Months.

Months.	Number of Deaths.	Mortality per 1,000 of Population.
January	555	8·10
February	507	7·40
March	585	8·54
April	570	8·32
May	764	11·15
June	591	8·63
July	477	6·96
August	522	7·62
September	422	6·11
October	387	5·65
November	469	6·84
December	555	8·10
TOTAL	6,404	7·79

The incidence of the mortality by months indicates in this year as in the previous year that the mortality from fevers is highest at the two periods of greatest subsoil fluctuation. I would draw attention to the importance of this phenomenon.

The incidence of the mortality by sections is very interesting. The section of highest mortality in 1894, namely Sewri (11·54), is again the section of highest mortality in 1895. The section of second highest mortality is Khara Talao (10·35), and the section of third highest mortality Mandvi (10·24). The first section, Sewri, is a district without drains but with an increasing population of mill-hands, and the high mortality is therefore, to some degree, probably connected with immigration and the increase of population. Khara Talao is a section with drains, mere rain-water channels, very imperfectly ventilated, very dilapidated, and with very little fall. I have so often described the imperfect sanitary state of Mandvi that I need not now do more than refer to the description of the district in the last Annual Report. There is a large sewer, giving most insanitary communications, running through the east of Mandvi, a sewer which from its high level, is difficult to flush except at high tide and very imperfectly ventilated. The sewer I refer to is the Frere Road sewer.

Cholera.—A very small mortality from cholera, namely, 90 deaths, was registered. The mortality is 336 less than in the last year and 112 less than the average. The disease cannot be considered to have been epidemic during the year. The mortality has been very low, in fact, most of the cases might have registered as choleraic diarrhœa. In the following sections, viz., Parel (0·45) and Mahim (0·37), the highest mortality occurred; they are in the suburbs, one forming the north boundary of the island.

Phthisis.—The mortality from phthisis is a little higher than in the last year. 3,610 deaths were registered, being 22 more than in the last year and 348 higher than the average. The death-rate is equal to 4 39 per 1,000 of population.

The mortality by sections is interesting. The five districts of highest mortality in 1894–95 are shown in a table following. It will be observed that the highest death-rate occurred in 2nd Nagpada, and that Umarkhari, which was the district of second highest mortality in 1894, is not amongst the five districts of highest mortality in this year. A system of drainage has been sanctioned for the Nagpadas. In regard to the reduction of mortality in Umarkhari, I would refer to the remarks in the last Annual Report.

The HIGHEST INCIDENCE of MORTALITY from the CHIEF DEATH CAUSES shown by SECTIONS.

All Causes.		Fevers.		Diseases of the Respiratory System.		Phthisis.		Debility.	
2nd Nagpada	50·61	Sewri	11·54	2nd Nagpada	10·28	2nd Nagpada	9·96	2nd Nagpada	7·14
Kamathipura	44·85	Khara Talao	10·35	Kamathipura	9·51	Chukla	7·73	Byculla	6·07
Tardeo	40·51	Mandvi	10·24	Chukla	8·88	Kamathipura	7·29	Tardeo	5·69
Khara Talao	39·24	Chukla	10·15	Khara Talao	8·87	Khara Talao	7·28	1st Nagpada	5·56
Umarkhari	36·51	Girgaum	9·88	Umarkhari	8·11	Bhuleshwar	7·22	Tarwadi	5·54
Chukla	36·49	Mazagon	9·78	Mahim	7·34	Umarkhari	7·16	Kamathipura	5·13
Byculla	36·11	Dongri	9.43	Tardeo	6·79	Kumbharwada	5·96	Mazagaon	4·75
Girgaum	35·85	Dhobi Talao	8·63	Mandvi	6·40	Girgaum	5:55	Parel	3·72
Mandvi	33·62	Tardeo	8·53	Worli	6·39	Mandvi	5·04	Sewri	3·46
Kumbharwada	33·59	Mahim	8·37	Kumbharwada	6·27	Tardeo	4·21	Dongri. Kumbarwada.	3·26

Diseases of the Nervous System.		Diarrhœa.		Small-pox.		Measles.		Cholera.	
2nd Nagpada	4·63	Worli	2·90	Girgaum	1·11	Dongri	1·48	Parel	·45
Mandvi	4·04	Kamathipura	2·63	Fanaswadi	·91	Girgaum	1·14	Mahim	·37
Girgaum	3·88	2nd Nagpada	2·61	Middle & Lower Colaba.	·80	Kamathipura	1·13	Mahalakshmi	·35
Chukla	3·66	Sion	2·60	Dhobi Talao	·65	Umarkhari	1·08	Tarwadi	·18
Umarkhari	3·50	Byculla	2·48	Parel	·55	Tardeo	1·00	Byculla	·18
Khara Talao	3·40	Tardeo	2·47	Tarwadi	·46	1st Nagpada	·98	Mandvi	·18
Bhuleshwar	3·23	Tarwadi	2·06	Mahim	·37	Sewri	·98	Fort, Northern	·15
Upper Colaba	3·23	Mahim	2·05	Byculla	·35	Fanaswadi	·87	Tardeo	·15
Fort, North	3·22	Umarkhari	1·77	Mazagon	·35	Byculla	·84	Kamathipura	·13
Kamathipura	2·97	Sewri	1·64	Kumbharwada	·34	Mandvi	·77	Sion	·10

Diseases of the Respiratory System.—There has been a very large reduction in the mortality from the diseases of the respiratory system. 4,565 deaths were registered,

being 820 less than in the last year and 115 more than the average. Of the deaths from diseases of the respiratory system, 2,632 were referred to bronchitis, being 721 less than in the last year and 137 less than the average; 1,354 were ascribed to pneumonia, being 47 more than the last year and 298 more than the average.

Digestive System.—The mortality from diseases of the digestive system is 594 less than the last year and 120 more than the average of the last five years. Of the deaths from diseases of the digestive system, 1,188 were ascribed to diarrhœa, being 410 less than in the last year and 13 more than the average; and 625 were referred to dysentery, being 121 less than in the last year and 45 more than the average. To all other diseases of the digestive system 678 deaths were ascribed, being 63 less than in the last year and 62 more than the average.

From diseases of the nervous system 2,044 deaths were registered, being 355 less than in the last year and 195 less than the average.

There has been a considerable increase in the number of births reported this year. 15,684 living and 1,470 still-born births were registered. Of the living births 8,150 were males and 7,534 females. The proportion of females to males by the census of 1891 was as 170·60 to 100, and, assuming that there were 100 males to 100 females, the birth-rate would be equal to 32·55 per 1,000 of population. This is the largest number of births registered since 1889.

APPENDIX.

No. 1.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT OF INDIA for 1895.

The year will be memorable for the failure over a great part of India of the usual autumn rains. From the cessation of the rains in September until the end of the year there was "practically or absolutely" no rain over a large part of the country. The rainfall of the whole year for the whole area of India was 3·38 in defect. Had this deficiency been uniformly distributed no calamitous failure of crops need have followed; but whilst, in the last three months of the year, the rainfall was in moderate excess in the southern part of the peninsula and in East Bengal and Cachar, there "was practically *nil* over the whole of Northern and Central India." The result has been a failure of crops and consequent scarcity of food for man and beast more wide-spread and severe than any hitherto recorded. Although this failure and the consequent scarcity began at once to make themselves felt, it will not be until the next year that their effects on the health of the country will become fully manifest. But the speed with which failure of the crops was followed by scarcity intensifying into famine shows the hand-to-mouth mode of life forced upon a people of great fecundity, multiplying without check within an area which their conservative habits forbid them to transgress in numbers sufficient to exercise any appreciable relief for the pressure of over-population.

2. *European Army of India.*—The instructions and suggestions of the Army Sanitary Commission in their review of the Report for 1893 have led to a thorough revision of the tables, with the welcome result that these now appear in a new and simpler form, whilst their number has been reduced by exactly half. Yet, as the Sanitary Commissioner remarks, "not only has nothing of "importance been omitted, but a considerable amount of fresh information has been furnished."

3. Although, judging from the admission and death rates, the health of the European Army was better than during the preceding year, yet the constantly sick rate per 1,000 of strength was higher. Whilst out of every 1,000 men only 60 were on the average constantly sick in the 10 years 1870–79, and only 73 in the 10 years 1881–90, the ratio rose to 92 in 1894, and now in the year under report to 94. It is disappointing to find that in spite of the advance of knowledge of disease and the sustained sanitary endeavour to maintain the health and consequent efficiency of the Army, only 906 are fit for duty out of every 1,000 men, as compared with 943 for the period included between 1870 and 1879. This result is not altogether to be explained by the change in the constitution of the Army; for the influence of the short-service system had come into effect before 1880, and yet the average number constantly sick in the years 1881–90 was only 73 as compared with 94 in the year under report. "The progressive increase in the constantly sick rate is probably "connected with the progressive increase in the number of cases of enteric fever and of venereal "disease, and with the increase since 1890 of influenzal respiratory diseases; that is, with the "increase of diseases which keep men long in hospital."

4. The ratio of admissions into hospital, amounting to 1,462 per 1,000 of strength, was somewhat less than that for 1894, and also than the average for the 10-year periods 1870–79 and 1881–90. The chief causes of admission were venereal diseases and ague. The former caused no less than 36 per cent. and the latter 23 per cent. of the total sickness. But, as usual, the chief factors in the production of sickness were not the chief causes of mortality. Of every 100 men of our European Army of young soldiers who died during the year, 44 died of enteric fever. The total number of deaths from this disease was 477; whilst, according to Table LIII., there were only 10 deaths from ague and 15 from venereal diseases. But, although the chief causes of sickness were not also the chief causes of mortality, they took the foremost place amongst the causes for invaliding.

5. Taking the year 1877 as the period when the short-service system began to seriously affect India, it may be said that, accompanying the increase of the proportion in the army of young and unmarried soldiers, there has been increased admission from enteric fever, ague, alcoholism, and venereal diseases. But whilst increase of sickness from these diseases has been associated with the change in the constitution of the army consequent on the introduction of the short-service system, there has been on the other hand diminished admission, death and invaliding ratios under all the remaining and more numerous headings. During the year, only 44 admissions and 32 deaths are recorded from cholera, against 209 admissions and 149 deaths in the previous year; whilst the ratio of mortality per 1,000 of strength from this disease has fallen from an average ratio of 3·22 in the 10 years 1870–79, to 0·45. This decrease may fairly be credited to improved hygiene. The decrease in remittent and simple and continued fever is probably due to change in diagnosis and

transfer to the head of enteric fever. Admissions from liver disease, the disease of the old soldier, have diminished by more than half since the introduction of the short-service system. In short, the alteration in the constitution of the army has been followed by increase in sickness and mortality from some diseases and by a compensating decrease from others, the outcome being that the total mortality from all causes has been reduced.

6. In the distribution of the European Army in India strategic considerations must of course be paramount; but the information given regarding the sickness and mortality prevailing in the geographical groups shown in the map facing page 18 might be useful as a guide in suggesting the location of troops when choice of locality is practicable. An examination of the health statistics of the several geographical groups shows, for example, that, whilst out of every 1,000 of the 7,068 men who on the average during the year formed the garrison of the Gangetic plain and Chutia Nagpur, 105 were constantly sick, or in other words, whilst of each 1,000 men only 894 were fit for duty, on the other hand, of the 3,781 forming the average strength of the garrison of Southern India, only 71 of each 1,000 were constantly sick, that is to say, 928 of each 1,000 of strength were fit for duty. Fractions have been omitted from the foregoing numbers. The 1,562 men who formed the garrison of the Western Coast group enjoyed nearly the same immunity from sickness as those of the Southern India group. In both groups the ratios of deaths from enteric fever were respectively 1·32 and 2·56 per 1,000 of strength, as compared with 7·36 in the Gangetic plain and Chutia Nagpur. Moreover, whilst in neither of these groups was there a single death from cholera, the ratio of deaths from this disease in the Gangetic plain and Chutia Nagpur was 2·12 of every 1,000 men. A glance at the table on page 20 will show that this comparative immunity from enteric fever and cholera was not confined to the year under report, but characterized the preceding year and the decade 1882–91. The report supplies abundant and exact information for further suggestive comparisons between the different geographical groups. Even hill stations compare unfavourably from a health point of view with Southern India and the Western Coast. In these hill stations the ratio of men constantly sick is higher, and the mortality from enteric fever greatly higher.

7. *Principal Diseases.*—Amongst the European troops *cholera* was fortunately in comparative abeyance, only 32 deaths having been caused by it against 149 in the previous year. The disease prevailed in epidemic form only in Fyzabad and Secunderabad. Beyond evacuating quarters no general movement of a body of European troops was made except at Fyzabad, and no case of cholera occurred after such movement. Likewise, in the 10 cases in which bodies of Native troops were moved, the moves were successful in all cases except one. In addition, prisoners were moved out of jail on 11 occasions, and no fresh case occurred after any of the moves. Prompt evacuation of the affected locality has been proved by the experience of a long succession of years to be the most successful method of dealing with outbreaks of cholera; and the experience of the year under report adds fresh testimony to the wisdom of this course. Another year of research into the vexed question of the exact cause of cholera leaves the question pretty much where it was before. Those who persistently assert that the *comma bacillus* is the one agent in the production of the disease will not find their assertion supported by the systematic examination of choleraic material continued at Calcutta. These investigations confirm the conclusion that, so far as Calcutta and its neighbourhood are concerned, "cholera is either an exceptionally rare disease, or one which is not necessarily "characterized by the presence and prevalence of any one species of vibrionic organisms within the "digestive tract, and has yielded additional evidence that there is no scientific ground whatever "for the assumption that all the vibrionic forms are mere varieties of one and the same species, and "that any such assumption can only be regarded as an arbitrary attempt to force facts to agree "with popular beliefs." But whilst these examinations are being carried out by experts, the practical means of preventing cholera, and of dealing with it when prevention has failed, are no longer a question of dispute. Persistent efforts to prevent disease generally, by an elaborate system of scientific sanitation, have already reduced cholera in the European Army to a fraction of its former fatality. This is exemplified by the figures for the year under report, when only 32 deaths were caused by this disease in an army of an average strength of 71,031 men. When, in spite of our sanitary efforts to prevent it, cholera does break out, prompt movement of the troops from the affected locality has rarely failed to arrest the further progress of the disease, provided the movement has been properly effected. This also is exemplified by the experience of 1895.

8. But whilst cholera prevalence is thus being steadily reduced, *enteric fever*, which has only come to be clearly identified as a distinct disease within recent times, has attained the foremost place as a cause of mortality in our short-service Army of India. During the year under report, 1,870 admissions, and 447 deaths were attributed to enteric fever; whilst 220 men were constantly sick from it, and each case lasted on the average 52 days. Notwithstanding that more is known about this disease than formerly, increased knowledge of it has not yet led to any decrease in its prevalence. On the contrary, "as compared with the corresponding ratios of 1894, the admission and "death ratios rose respectively by 5·4 and 0·97 per 1,000 of strength." So late as 1877 the recorded death-rate was only 1·60 from enteric fever in India; in 1895 it was 6·72. Undoubtedly part of this increase is due to the increased frequency with which of late years the diagnosis of enteric fever has been made, as well as to increased susceptibility to the disease on the part of the army from youth and recent arrival. Nearly 17 pages of the Report are devoted to a useful *résumé* of what is at present known and believed regarding enteric fever. The bewildering conflict of opposing views held by those who claim to be considered experts in the bacteriological investigation of the disease leaves us in doubt as to which of these views should be accepted. But of the wisdom

of the Sanitary Commissioner's conclusions there can be no room for doubt. "Finally," he says, "it must be borne in mind that, though nowadays more is known about enteric fever than in former "times, still much remains involved in mystery; and that as all the avenues of approach of the "disease may not have been discovered, no single point of hygiene should be neglected."

9. *Venereal diseases* have still further increased in prevalence during the year under report, the admission rate caused by them having reached 522·3 per 1,000 of strength, the highest hitherto recorded. The Army Sanitary Commission having so recently expressed their views on the question of the prevalence of these diseases amongst our British troops in India, it is not considered necessary to refer at length to the subject in this place. We may remark, however, that the great and increasing prevalence of this class of disease in India is most lamentable, and we are glad to learn that an earnest attempt is being made on the part of the Indian Government to devise some measures for dealing with it. The evil has reached dimensions which threaten to be ruinous to the efficiency of the European Army in India, to say nothing of its far-reaching and dreadful effects on a number of innocent persons in this country.

10. *Native Army.*—Although the ratio of mortality was nearly the same in both the European and Native Armies, having been 15·26 in the former and 15·71 in the latter, including those absent at the time of their death, the ratio of admissions into hospital among Native troops was only 794 per 1,000 of strength against 1,462 amongst European troops; whilst the constantly sick ratio was only 30 amongst the former as compared with 94 amongst the latter. The contrast between the two armies in respect of the causes to which sickness and mortality were due is striking. Whilst in the European Army 44 out of every 100 deaths were caused by *enteric fever*, only a fraction of 0·6 is recorded against this disease in the Native Army. On the other hand, 42 out of every 100 deaths resulted from *respiratory diseases* in the Native Army, and only 3·7 in the European Army. The cause of the comparative immunity of the Native Army from enteric fever is still more or less uncertain; but with regard to the greater fatality from respiratory diseases, the Sanitary Commissioner writes of *pneumonia*, the most fatal of these:—"The Europeans suffered much less than the "Natives, probably because they are more accustomed to cold, because they are better clothed, and "because they are more nutritiously fed." These reasons suggest some of the measures which might be adopted with the view of lessening the liability of our Native soldiers to the disease.

11. Whilst the incidence of enteric fever and respiratory diseases is so strikingly different in the two armies, the mortality from some of the other principal diseases was much the same in both. Of every 100 deaths in the European Army, 3·0 were due to *cholera*, as compared with 3·5 in the Native Army; and whilst of every 100 deaths in the former 7·3 were caused by *bowel complaints*, 6·6 were due to the same diseases in the latter.

12. The comparative liability of the two armies to sickness and mortality from *ague* may also be noted. Whilst of the admissions into hospital of European troops 23 per cent. were due to ague, the percentage amongst Native troops was 36; and whilst of every 100 deaths amongst the former 1·7 were due to ague, the percentage was 5·1 amongst the latter. Perhaps the explanation of this contrast may, to some extent, be the same as that already given of the greater liability of Native troops to pneumonia.

13. From *venereal diseases* the Native Army enjoyed its usual immunity. The ratio of admissions into hospital per 1,000 of strength was only 31·3, as compared with 522·3 in the European Army.

14. In our Memorandum for 1894, we suggested that one of the causes of the prevalence of respiratory diseases in the Native Army might perhaps be found in the overcrowding and defective ventilation reported to exist in the quarters occupied by some of the corps. In Table XXX. of the Report for 1895 giving a brief statement of sanitary defects existing in the lines of the most unhealthy regiments, we find that in the case of 11 out of those 48 regiments overcrowding or defects in ventilation are reported. The influence of these insanitary conditions in the production of disease generally, and more especially of respiratory diseases, is well known.

15. *Jails.*—"The year was one of much sickness, though the death-rate was considerably reduced." As usual, *ague* was one of the chief causes of sickness. Of the total admissions into hospital, 35 per cent. were due to this disease, the percentage being nearly the same as in the Native Army, in which it was 36. As from year to year they have hitherto been, *bowel complaints* and *respiratory diseases* were the chief causes of mortality. During the year under report, *dysentery* caused 26 per cent., and *pneumonia* 14 per cent. of the total number of deaths. In the European and Native Armies, as in jails, the increase in respiratory diseases is said to have been at least to a large extent due to the epidemic of influenza which began in 1890. Of the total 2,936 deaths, which according to Table LIII., took place in Indian jails during 1895, no fewer than 1,003 were due to dysentery and diarrhœa. Prevalence of bowel complaints points to the need for improvement, more especially in the quantity, quality, or cooking of the prisoners' rations. The more fatal of the respiratory diseases, pneumonia and tubercle of the lungs, caused together 608 deaths. From an examination of Table XLIV., we find recorded against 39 of the 68 most unhealthy jails that they were overcrowded to varying degrees, or that their ventilation was in some respect defective. Taking into consideration the heavy mortality from respiratory diseases, a serious responsibility rests on those who permit the continuance of conditions universally recognised to be powerful factors in the causation of these diseases. Regarding the mortality from pneumonia in the Punjab jails, the Sanitary Commissioner observes:—"It seems desirable that extra clothing should be issued during the cold

" season to the prisoners in those jails where this disease is most prevalent, and that hospital " accommodation with proper appliances for keeping the air at an equitable temperature should be " provided for patients with respiratory diseases."

16. The subjects dealt with in the remaining sections of the Report have been, as far as seems needful, separately noticed by us in our memoranda on the several provincial sanitary and vaccination reports.

19th July 1897.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner for Bengal for 1895.

1. Taking into account the decrease of the death-rate, it may be concluded that, for the Province as a whole, the year was healthier than its predecessor. It is pointed out by the Government of India, that no information has been given concerning the influence of meteorological conditions and the price of food-grains on the general health of the people, and the request made that this may not be omitted from future reports.

2. *Vital Statistics.*—The *birth-rate* shows a substantial increase over that recorded for 1894, whilst there was a marked decrease in the *death-rate*. Compared with the birth-rate of 50 per 1,000 of population estimated by actuaries, 34·59, the rate recorded for 1895, shows that registration, although it has greatly improved since 1892, is still defective. Similarly, the divergence between 31·39, the recorded death-rate, and 44, the rate estimated by actuaries, is too wide to be explained, except on the supposition that a large proportion of the deaths escaped registration. The question of improving the registering agency is stated, in the Government Resolution on the Report, to be under consideration in connection with a general scheme for re-organising the Sanitary Department in Bengal. But the satisfactory results obtained, from what appears to be the same system of registration in the North-Western Provinces and the Punjab, would suggest that the system is probably not so much in fault as the way in which it is carried out.

3. *History of Chief Diseases.*—Although the recorded number of deaths from *cholera* was less than during the preceding year, it reached 177,087, or a ratio of 2·49 per 1000, of population, as compared with 3·32 in 1894. Mortality from the disease varied from the high ratio of 7·08 deaths per 1,000 of its population of 2,395,602 inhabitants in the Dacca district, to 0·03 in Lohardaga. The Sanitary Commissioner thinks that "in the present undetermined state of the etiology of this mysterious disease," it would serve no useful purpose to attempt an explanation of the varying degrees of its virulence, or to enter into the difficult question of the cause of immunity of persons and places. Whilst, like most sanitarians, attaching the greatest importance to the provision of a pure water-supply as a means of preventing cholera, he would not confine attention so this alone. "The " importance of drainage and stricter conservancy has been repeatedly brought to notice, as well as " the necessity of improved means for the supply, and still more, for the distribution of water; " indeed, the great value of a pure water-supply, as a preventive of cholera, can hardly be over " estimated, nor the great importance of drawing it from a source beyond suspicion of contamination." He would like to see villages provided with sanitary wells—in other words, with wells having their water properly protected against pollution. In our memorandum on last year's sanitary report for Bengal, we described what Dr. Banks, the Civil Surgeon of Puri, had already accomplished in this direction. Along the pilgrim roads leading to Puri, closed pump wells are provided for the supply of drinking water, which is thus secured against pollution. If the inhabitants of rural Bengal could be educated to appreciate the value of, and carry into effect an arrangement which, without infringing their caste customs, preserves the purity of their drinking water at little cost, a sanitary improvement of a more far-reaching nature than the supply of filtered pipe-water to the towns of the province would be brought about. After all, the inhabitants of the town circles do not constitute more than about one-twentieth of the population of Bengal.

4. *Small-pox.*—The mortality from this disease exceeded that of the preceding year, and was also considerably greater than the average of the past ten years. It comes as a surprise to find the city of Calcutta the centre of a severe epidemic of this disease, which "at one time threatened to " create considerable havoc in the surrounding districts, but the latter, thanks to their high degree " of protection, are to be congratulated on the comparatively small number of cases that occurred in " them, and the low mortality." The Sanitary Commissioner takes care to explain that Calcutta is not under the jurisdiction of the Bengal Vaccination Department. The more would seem to be the pity, if we may judge from results. For the protection of its inhabitants against this preventible disease, the Municipal Corporation has its own arrangements, supervised by its own special Health Officer. Seeing that, whilst the mortality from small-pox averaged only 0·18 for the province of Bengal, as a whole, it was 3·25, or nearly 20 times greater in the town of Calcutta; these arrangements, or their supervision, would appear to need improvement. As usual, young children suffered more in proportion than adults. Of the 13,020 deaths from small-pox, no fewer than 6,631, or more than half, occurred amongst children under 12 years; and of this latter number 1,924, occurred amongst infants under one year of age. When we refer to the separate vaccination report

the explanation is apparent. In the table given in paragraph 6 of the report, it is shown that, whilst there were 2,460,469 "surviving population under one year available for vaccination," only 416,307 were protected against small-pox by vaccination, or nearly one in six. As Dr. Dyson remarks, the degree of protection afforded to infants under one year of age is the proper test of the working of the Vaccination Department. In connection with the epidemic of small-pox in Calcutta, we find, on referring to the table given on pages 16 and 17 of the separate vaccination report, that of the total number of operations, amounting to 18,913, only 154 were inspected by the Health Officer, and that, of this small number, only 69 were found to be successful.

In paragraph 15 of his report on vaccination, the Sanitary Commissioner gives an interesting statement with the object of showing the comparative value of the three methods of vaccination at present practised in Bengal, viz., direct from the calf, with lanoline paste, and the arm-to-arm method with human lymph. If the value of each is to be estimated by the resulting ratio of success, the last of the three, or arm-to-arm method, is the best; next to this comes vaccination with lymph taken direct from the calf; whilst, as might have been expected, the lanoline-paste method is the least successful of the three. Dr. Dyson is himself in favour of lymph used direct from calves. He says he is not prepared to admit that lymph "when properly procured by the arm-to-arm process, and "from healthy children, is of equal value to the lymph procured directly from calves"; but, even supposing it to be the case, the difficulty is always to procure healthy subjects. "Invariably," he adds, "the children used as vaccinifers are low caste and unhealthy." This statement is surely too absolute. Unhealthiness is not an invariable characteristic of low-caste children.

We are glad to see that, as the result of increased strictness of supervision, the percentage of successful cases of vaccination has fallen from 99·26 in the previous triennial period, to 95·38 in the triennial period 1893–96. Anyone having a practical acquaintance with vaccination work in India cannot help suspecting the accuracy of the returns which show a percentage of 99 and upwards of successful cases. The statement that "the degree of protection afforded by vaccination bears a definite "relation to the number of successful vaccination marks" needs some qualification. If the operation is performed by inserting the vaccine lymph by means of a puncture with a lancet, the resulting cicatrix will indicate a less protective value than if the lymph were inserted into the scratches made by the vaccination needle used in some provinces. In the latter case the cicatrix, or "foveated area," may be several times more extensive than the cicatrix, following a puncture with a lancet. When the needle instrument is used, it will be seen that several separate vesicles generally at first appear, that these, by and bye, coalesce, and that when the resulting scab falls off, one "mark" or cicatrix only remains. But this cicatrix, as we have said, may have a "foveated area" equal to that left by several separate vesicles following single punctures with a lancet. It will hardly be contended that the cicatrices in each case—those resulting from several vesicles which have coalesced and have left a single, large, typical "mark," and those resulting from a single vesicle, which leaves, also, a single, but smaller, typical "mark" indicate equal protective values.

5. *Fever.*—The ratio of deaths attributed to this disease decreased from 25·32 in the previous year to 22·99 during the year under report. Although, as Dr. Dyson says, the term "fever" covers a multitude of complaints in the minds of the registering agents, in the main, he thinks, it may be taken that the majority of the so-called fevers entered in the mortuary returns are of malarial origin. An examination of the fever map shows that, whilst there is more fever in the parts of the province which are made up of alluvial soil than in the portions of older formation, high mortality is by no means confined to the alluvial tracts. "It is, however, my decided opinion," the Sanitary Commissioner writes, "and, I believe, it is also the opinion of the majority of the local medical officers and of others "who have given the matter serious attention, that in Bengal malarial fever is, on the whole, "associated with the stoppage of natural drainage." Removal of this stoppage is obviously the remedy for this prevalence of malarial diseases; but a general system of drainage for a country of the size and physical conformation of Bengal may, for the present, be regarded as beyond the resources of any Government to carry out and maintain. The most that can be expected is an endeavour to improve the drainage of specially water-logged and unhealthy tracts. Even on this limited scale, the maintenance of the drainage in an efficient state in a country liable to frequent inundation with its resulting alterations in the features of the localities affected, would entail a heavy and recurring expenditure. We have still much to learn regarding the causation of the epidemic prevalence of malarial fever; and outbreaks of the disease, such as that from which Bihar suffered during late years, are deserving of special investigation.

6. *Sanitary Works.*—"Out of 23½ lakhs of rupees spent on sanitation (excluding roads)," it will be seen that, in round numbers, 2 lakhs and 74,000 rupees were spent on "drainage," 7 lakhs and 98,000 on "water-supply," and 3 lakhs and 31,000 on "treatment of the sick." The contrast of expenditure on so limited a scale with the sanitary needs of so great a province creates a sense of the inadequacy of the means to the end to be accomplished. Such sanitary improvements as have been recorded are mostly confined to municipal towns. Of the villages, Dr. Dyson writes:—"The reports "of the local officers do not show that any attempt was made during the year under report to effect "improvement in regard to village sanitation, and, as far as my limited experience of the province "goes, such a thing does not seem to exist in any form whatever."

19th July 1897.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-Western Provinces and Oudh for 1895.

Judged of by its vital statistics the year 1895 was one of the healthiest on record. Its death-rate of 29·13 per 1,000 of population is in striking contrast with that of 1894, which was 42·51. To some extent the low mortality of the year under report was doubtless the consequence of the high mortality of its predecessor. As we have remarked in another memorandum, an unhealthy year largely eliminates from the population the very young, the very old, and the constitutionally feeble, besides lessening fecundity and so reducing the birth-rate of the year following. Relieved of the portion of its population least capable of resisting sickness, and having its birth-rate, which always has a marked influence on the death-rate, greatly reduced, 1895, from these circumstances alone, might have been expected to show a lessened mortality. But, in addition, "there was no scarcity, and climatic conditions were favourable to health."

2. *Vital Statistics.*—The *births* exceeded the deaths by 270,792 ; whilst in the preceding year the deaths exceeded the births by 131,743. Although the year under report was exceptionally healthy, its birth-rate was much below that of 1894, which was exceptionally unhealthy, showing that, as might be expected, the birth-rate of a year is regulated not so much by its own health conditions as by those of its predecessor.

3. Of *deaths* there were 1,366,443 registered against 1,993,778 in 1894. That the registration of births and deaths in these provinces is, considering the agencies employed in carrying it out remarkly accurate, was strikingly shown by the last enumeration of the population in 1891. The population numbers got by adding to the census figures of 1881 the births registered in excess of deaths for the intercensal period 1881–90, were in 1890 found to be 46,842,838 ; and the population numbers got by the actual counting of the people in the following year, 1891, was 46,888,557. So close an approximation in results cannot fail to establish confidence in the efficiency of the system of registration in force. The Sanitary Commissioner is fully justified in saying :—"The collection of "statistics for this vast area and population is carried on by the village watchman, the only method "possible with any regard to reasonable economy, and, upon the whole, is wonderfully well "performed. Probably it is one of the most efficient reporting agencies, at the price, in the world." Inherently sound, however, as the system has proved itself to be, it no doubt owes its efficiency largely to the close supervision and check to which it is subjected by the local authorities and the Vaccination Establishment. Twenty-one per cent. of the births and 20 per cent. of the deaths registered in 1895 were tested by these agencies. In the testing done by the local authorities the percentage of admissions works out for the province at 2·78 per cent. in the case of births, and 2·64 per cent. in the case of deaths ; whilst, in the testing done by the Vaccination Department, the percentages are 1·46 and ·72 respectively for births and deaths. The Lieutenant-Governor concludes from these figures that the testing of the Vaccination Department would seem to be perfunctory. Before agreeing to such a conclusion it would be necessary to know what the system of testing by the two agencies actually was. As we have had occasion more than once to observe, no mere examination of the watchmen's handbooks and of the police registers can be regarded as an efficient testing of registration of births and deaths. This can only be effected by a house-to-house inquiry, and a comparison of the results so obtained with the entries in the handbooks or the registers. The process is tedious and laborious; but, so far as we know, it is the only one by which the actual facts can be got at. It has hitherto usually been found that the proportion of births omitted from the registers was considerably in excess of the proportion of the deaths so omitted ; and this the figures obtained as the result of the inquiries of the Vaccination Department would confirm, the proportion found by them being about two of the former to one of the latter. It may be, however, that the births of children more directly concern the vaccinators, and that, as a consequence, their registration is subjected to a more searching scrutiny.

4. *Chief Diseases.*—The returns show that there was a substantial decrease in the mortality under the head of each of these diseases. The number of deaths from *cholera* fell from a ratio per 1,000 of population of 3·80 in the preceding year, to 1·10 in the year under report. The year began badly, no fewer than 2,839 deaths from this disease having been registered in January alone. In no one of the previous 14 years for which statistics are given in the table on page 21 was the mortality from cholera so high in this month. December of the preceding year has recorded against it 7,349 deaths from cholera; so that the prevalence of the disease in the beginning of the year under report was not due to a fresh outbreak, but was merely a continuation of the epidemic of 1894. In February it appeared to be subsiding; but this appearance was delusive; it again increased in March and April, attaining its greatest intensity in May. After this it again decreased until November, during which, instead of subsiding, as it almost invariably does, it on the contrary suddenly increased, and caused more than twice the number of deaths attributed to it in the preceding month. In December it showed little sign of abatement. These peculiarities in the cholera history of the year are well brought out by the Sanitary Commissioner, who remarks :—"But for this "prevalence of cholera in the concluding months of the year, 1895 would have been a decidedly "healthy year as regards this disease." It is important to note the climatic conditions which accompanied this unusual recrudescene of cholera in November. "The principal meteorological "features of the year were the defective rainfall during the last four months of the year, and the

" abnormally high temperature prevalling in November." In paragraph 189 of his report, Dr. Thomson writes:—" The abnormally high temperature in November has been referred to. It is " probable that it affected the health conditions of the province, more particularly in retarding the " decline of cholera mortality in the eastern districts."

5. *Small-pox.*—The mortality from this disease was the lowest ever recorded in the province; there were only 1,968 deaths attributed to it, giving a ratio per 1,000 of population of 0·04. The table given on page 23 of the Report illustrates the gradual decrease of small-pox during the past 25 years. Not since 1890 has the mortality from this cause reached so high a ratio as 1 per 1,000 of the population. But rapid as the progress of vaccination in recent years has been, and decided as have been its protective effects, it would be a delusion to believe that epidemics of small-pox would no longer recur. The most that can be looked for is, that these recurring epidemics will be less violent. The influence of vaccination on small-pox prevalence is well put in the Orders of Government on the Sanitary Report:—" The disease has periods of advance and retrocession, but the table giving the " small-pox death-rates for the past 25 years at page 25 of the Report shows unmistakeaby that each " epidemic wave advances less and recedes farther than its predecessor." So long as the children under one year of age successsfully vaccinated number little more than a third of the number of births, small-pox is little likely to die out for lack of material to keep it alive. In the year under report three were 1,637,235 births registered; whilst 349,700 children died, leaving 1,287,535 available for vaccination. Of these last, only 570,002 were successfully vaccinated during the season 1895–96, leaving unprotected against small-pox 717,533. But whilst these figures show that infant vaccination is still backward, the figures for the group of children between one and six years show that the arrears of unprotected children remaining at one year of age have been largely overtaken within the next five years. Taking the vaccinations performed at all ages, these equalled 79·76 per cent. of the births. " This is a closer approximation to the birth-rate than has ever been attained before." We are glad to see an order issued to the effect that " hot weather vaccination operations " shall only be carried on when small-pox is present in any district in an epidemic form." The inexpediency of carrying on vaccinations in the plains during the hot season was almost from the first fully recognized by the Vaccination Establishment; but it was hastily concluded that in coming to this conclusion the vaccination staff might be biassed in favour of an arrangement which set them free from work in the plains, and found some of them employment in collecting vaccine lymph in the hills during the hot season of each year. Experience has shown that in this instance bias, if any ever existed, coincided with the safest and best method of carrying out the work of the Department.

6. *Fever.*—There was a marked diminution in the fever mortality in the year under report as compared with 1894. The ratio of deaths from this cause per 1,000 of population fell from 31·88 in the latter year to 23·31 in 1895. The beneficial effects of the drainage of water-logged tracts of country in lessening fever prevalence have been well exemplified in such districts as Meerut, Aligarh and Bulandshahr. It is an axiom in practical sanitation that, when a water-supply is introduced into a town, arrangements should be made for its removal after it has served its purpose. Similarly, when water for purposes of irrigation has been distributed over a tract of country, a system of drainage should be provided for the removal of the surplus water which would otherwise remain to water-log the soil, and generate or intensify malarial diseases. There is probably no exception to the rule that the health of a water-logged country is improved by efficient drainage.

7. *Sanitary Works.*—In no other province of India has so much progress been made in providing the larger towns with one of the first essentials of healthy life, a pure water-supply. Already the great cities of Benares, Allahabad, Cawnpore, Agra and Lucknow have their water-supply schemes completed; whilst other large towns, such as Meerut, Fyzabad and Farukhabad are either carrying out or considering similar schemes. The drainage works, which are the necessary complement of a water-supply, will tax the resources of those cities and towns for their completion, but completed they must be if the introduction of the water-supply is to prove an unmixed benefit to the public health. It is too early yet to look for decisive proof in vital statistics of the beneficial effects which ought to follow the substitution of a pure for an impure water-supply. The Sanitary Commissioner is of opinion that " in no town in these provinces do more than 75 per cent. of the inhabitants use " filtered water," the remainder still continuing to draw their supplies from the numerous and frequently polluted wells which abound within the inhabited area. Moreover, the beneficial effect of a pure water-supply will be to a measurable extent neutralized by the water and sewage logging of the soil which inevitably result from the introduction of water into a town without the provision of means for its effectual removal when it has fulfilled its uses.

8. The Government of India consider the notes on the sanitary conditions and defects of towns and districts given in the last four columns of Annual Form II. to be frequently of too general a character, and to refer to the district as a whole instead of to individual towns and circles separately. This is quite true; but when it is considered that there are no fewer than 1,392 towns and rural circles, some idea may be gathered of the magnitude of the task involved in furnishing a special description of the sanitary conditions and defects of each within the period fixed for the submission of the Annual Report.

19th July 1897.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1895.

During the year the meteorological conditions were more favourable to health than usual; the weather was milder, and the rainfall considerably below the average. This last-mentioned condition, however, although known to be directly conducive to lessened sickness and mortality from fever and bowel complaints, had an unfavourable influence on the crops, and so indirectly tended by raising the price of food to lower the disease-resisting powers of the poorer classes. The consequences of this rise in the prices of the ordinary articles of diet, and the resulting reduction in the stamina of the poorer classes, forming everywhere in India a large proportion of the population, would not at once be reflected in the statistics of mortality, unless the rise in prices were sudden and great. It is during the following year that both the birth and death-rate may be expected to bear witness to the effect of this rise in the price of food in 1895. From the table given in paragraph 30 of the report it appears that, whilst in 1894 one rupee would buy 23 seers of wheat, it would buy only 21 during the year under report, and that whilst in the former year it would buy 20 seers of the pulses in common use, it would buy only 14 seers in the latter year. As a slight set-off against this increase, the price of rice fell from 10 seers per rupee in 1894 to 11 seers in 1895. The Lieutenant-Governor, in paragraph 7 of his remarks on the report of the Sanitary Commissioner, points out that it was unnecessary to fill 4½ pages of print giving meteorological details for each month of the year, whilst at the same time omitting to draw any deductions therefrom as to the influence which the weather conditions exercised on the health of the Province. "The Government of India," he adds, "probably only wanted such observations on the weather and food prices as would really be of "some help in considering the causes of the recorded birth and death-rate. An undigested "statement of weather conditions and a table of prices does not help us." Thus simply stated, the probable object the Government of India had in view seems so obvious that the wonder is it could have been overlooked.

2. *Vital Statistics.*—As usual, the *birth-rate* of the Punjab is greatly higher than that recorded for any of the other provinces of India. In the year under report it was 43·86 per 1,000 of population, the North-Western Provinces coming next with only 34·90. This ratio would seem to speak well for the care with which births are registered in the Punjab, but the Lieutenant-Governor thinks it is not easy to say how far it is due to a better system of registration and how far to other causes. Excluding the small hill district of Simla, the circumstances of which are exceptional, the birth-rate varied from a minimum of 34·8 in the Kangra district, to 54·4 in the Gujranwala district. Yet, comparatively high although the ratio of the Province is, there are good reasons for believing that if all the births had been recorded it would be considerably higher. When we compare the proportion of the sexes born, we find, for the province as a whole, that for every 100 births of female children there were 110·6 births of males recorded. This proportion may, of itself, be taken to indicate the omission to register a considerable number of the births of females. Selecting some of the frontier districts, we find the incredible proportion of 141·4 male to 100 female births in the Peshawar district, and of 128·9 to 100 in the district of Dera Ghazi Khan. The divergence in the recorded numbers of the sexes born may pretty safely be assumed to increase with the inaccuracy of registration, and to lessen as improvement takes place. In our memorandum on the report of the Sanitary Commissioner of Bombay for 1894, we remarked:—"As in the case of his birth, so likewise "as regards his death, a male is held to be of more importance than a female, and the registration "of either his birth or his death is less likely to be omitted." The Lieutenant-Governor in paragraph 3 of his remarks alludes to a more serious cause for the omission to record births of female children in certain districts of the Province. In his opinion the result of inquiries proves beyond a doubt that "female infanticide, using the expression in the wider sense as including also mere "deliberate neglect of female infants, still prevails to a most lamentable extent" among certain classes. In addition to the reasons we have given for believing that all of the births are not registered, we have direct evidence in support of this belief. During the year, the Sanitary Commissioner, two Civil Surgeons and the Vaccination Staff, together with some of the tahsildars and their assistants, discovered the omissions from the registers tested by them of 27,244 births and 11,182 deaths. As but a small proportion of all of the registers could have been examined by these officers, it may be concluded that from the registers of the Province as whole, the births and deaths omitted must have amounted to a total which would materially affect the accuracy of the returns.

3. Under the healthy climatic conditions which characterized the year, the *death-rate* was only 29·29 per 1,000 of population, as compared with 36·32 in the preceding year. There was no unusual prevalence of epidemic disease, and there was a marked diminution of fever mortality. According to sex there were 112 deaths of males to every 100 deaths of females, whilst, according to age, the death-rate of male children under one year of age was 218·05 per 1,000 of population to 210·14 of female children of the same age. Judging from the number of persons punished in the 151 municipal towns of the province for failure to register births and deaths, the byelaws are, as the Sanitary Commissioner says, a dead letter in many of these towns. Those fined for neglect of registration numbered 117, and the fines amounted to a total of 99 rupees. The Sanitary Commissioner is confident, however, that the agencies now at work in checking the registers of mortuary statistics will before long make registration as perfect as can be expected. But, as we remarked in the second paragraph of our memorandum on the Report of the Sanitary Commissioner of the Hyderabad assigned districts, inspection of registration to be effective must be thorough. Examination of registers, conducted as described in paragraph 24 of the Report, is worse than useless,

inasmuch as it encourages neglect by conferring on those guilty of it a sense of security that they will not be found out. In the registers of as many as 564 villages inspected by tahsildars and their assistants there was only one omission discovered in the birth, and one in the death register. Such inspection Dr. Roe describes as a "mere farce."

4. *Chief Diseases.*—During the year under report, as during its two predecessors, *cholera* prevailed to only a slight extent. There were, altogether, 549 deaths registered from this disease, equal to a ratio per 1,000 of population of only 0·03. Compared with the other chief diseases, cholera plays an unimportant part as a cause of mortality in the Punjab. Only in three of the last 29 years has the death-rate from it reached one per 1,000 of the population; and it is significant that in two of those three years there was a *kumbh-mela*, or great bathing fair at Hardwar. The Punjab invariably sends a large contingent of pilgrims to these fairs; and, when epidemic cholera breaks out in the vast multitude assembled at Hardwar, numbers contract the disease and carry it back with them to their own country. The last great epidemic in the province occurred in 1892, which was not itself a *kumbh-mela* year, although immediately following one. During 1895 the disease was chiefly confined to the Umballa district; in fact, 511 of the 549 deaths caused by it took place in that district alone. Particulars of the outbreaks of the disease in the Umballa district are furnished by Assistant Surgeon Alla Dita, who inquired personally into the matter. It is difficult to believe that the Sanitary Commissioner expects the Assistant Surgeon's evidence to be accepted as sufficient proof of the importation of cholera. A man, we are told, came from Rajpura, in the Patiala State, to the village of Chunian Khurd, was attacked at the latter place with cholera symptoms on the 19th April and died on the 22nd April. This case was reported in the Chaukidar's death register as a case of fever, but, after "careful inquiry made by me," writes the Assistant Surgeon, "I am of opinion that Kirpa "Ram, who came from Rajpura, brought the disease with him. Cholera was prevailing there in "epidemic form for the past month." It would appear that the Assistant Surgeon did not himself see the case, and that the evidence afterwards obtained by him as the result of his inquiry consisted merely of what the villagers could tell him about it. Even the date on which the inquiry was made is not stated. The next five cases of cholera following the supposed death of Kirpa Ram from that disease on the 22nd April took place on the 28th of the same month. "These cases occurred in the "vicinity of Kirpa Ram's house." On the 29th of April five more cases occurred. "In my opinion," writes the Assistant Surgeon, "the well in the village of Chunian Khurd, from which the "water-supply was obtained, was contaminated, which is the cause of the spread of the disease. "It is a common practice in the villages to bathe on the side of a well, and to wash their clothes "on the same spot; in this way the water-supply is contaminated. In Chunian Khurd the "contaminated well was closed about the 30th April 1895, and the water was then obtained from "wells situated at about 200 yards distant from the village. After stoppage of water-supply from "contaminated well the disease disappeared." The statement is so illogical and rests so entirely on opinions and assumptions, not on exact facts, that it would not have been noticed by us but for the circumstance of its being apparently accepted by the Civil Surgeon as conclusive proof of importation of cholera into the Umballa district. Dr. Young, in forwarding the above particulars, writes:—"The epidemic in this district thus imported began at the village of Chunian Khurd," &c. It is instructive to contrast this case of assumed importation of cholera into a village with the account of the appearance of the disease in five jails given in our Memorandum on the Report of the Sanitary Commissioner of the Central Provinces. Although these jails were under the constant supervision of medical officers, yet the most careful inquiry on the spot and at the time the disease first showed itself left it doubtful as to how cholera found entrance into any one of the five.

The system of attempting to disinfect wells, the water of which is suspected of communicating cholera, was practised in the Umballa district. The Lieutenant-Governor subjects the account given of the results to a careful judicial examination, and shows very clearly that experiments of the nature described will have to be conducted with more regard to scientific method before safe deductions can be drawn from them.

5. *Small-pox* is credited with having caused 8,334 deaths during the year. Of this number, 2,442 occurred amongst children under one year of age; whilst of children under 12 there were altogether 7,686 deaths. These figures point to neglect of vaccination of young children; and the existence of such neglect is abundantly proved by the inquiries of the Civil Surgeon of Umballa.

In the frontier districts, outbreaks of small-pox are stated to have been caused by the operations of inoculators; and it is proposed to endeavour to induce these men to give up the practice of their own craft and become vaccinators. Experience in other provinces has shown that converted inoculators rarely become good vaccinators. Their former calling was so much more profitable, and carried on under conditions so comfortable and congenial, that many of them were found to clandestinely revert to it, especially during the hot season, when risk of detection was least. They find the lot of the vaccinator, urged on by his superiors to continual exertion, and often opposed and rudely treated by the parents of children whom he must vaccinate without reward, by no means an enviable one.

The record of vaccination for the season 1895–96 is a good one. There were 645,846 primary cases returned as successful, against 616,456 in the previous year, giving a percentage of success of 93·10, as compared with 93·75 in 1894–95. Of the total successful primary vaccinations 487,217 were performed on infants under one year of age, and 153,692 upon those of over one and under six years. The appointment of six Divisional Inspectors affords an additional guarantee of the accuracy of the recorded work. Increased vigilance and strictness on the part of the supervising staff have caused some decrease in the percentage of cases recorded as successful; but there has doubtless been a corresponding decrease of "returns falsified, and children returned as successfully vaccinated when

" they were not." The practical test of the efficiency of vaccination is its influence in preventing small-pox; and if we turn to the table given in paragraph 31 of the Sanitary Commissioner's Report we find a marked diminution in the mortality from this disease in the Punjab during the past 29 years which the record covers. During the first seven of those 29 years the mortality never fell below 1 per 1,000 of the population, and during one of them was over 3. During the last 16 years the mortality from small-pox never reached 1 per 1,000, and has generally been less than half of this.

In the year under report 93 per cent. of the operations were performed with buffalo lymph; but the increasing difficulty of obtaining buffalo calves has been found to be a great hindrance to progress. Dr. Roe believes, however, that he has at length succeeded in overcoming this difficulty by substituting preserved for fresh lymph. The method adopted for the preparation of this preserved lymph is that practised in Berlin, "with the exception of vaseline being used as the vehicle for the vaccine instead " of glycerine."

6. *Fever.*—The deaths attributed to fever were fewer than during the preceding year by no less a number than 123,120. Yet did the death-rate from this cause in an exceptionally healthy year reach the high ratio of 19·08 per 1,000 of population. A special report has been called for by the Government on the question of fever prevalence in the Province; and the Sanitary Commissioner states that he is collecting the materials necessary for its preparation. "The Lieutenant-Governor " trusts he will receive at least an instalment of this report before long, and that it will help us to " get beyond the region of vague generalities and conjectures." After all, cholera, to the investigation of which so much attention has been given, is in the Punjab an altogether trifling cause of sickness and mortality when compared with fever. While the deaths attributed to cholera during the year numbered 549 those attributed to fever numbered 392,118.

7. *Sanitary Works.*—Of these it is stated that the list, " both completed and contemplated, is as " satisfactory as can be expected under existing financial conditions." With the opinion expressed by the Lieutenant-Governor, that, in considering schemes for the better sanitation of villages, attention should be concentrated on the water-supply, we cordially agree. The improvement of the water-supply is a clear and definite object which, if carried out, no one doubts will be followed by marked benefit to the public health. As yet few of the villages possess an abundant supply of pure water, universally acknowledged to be one of the finest conditions of healthy existence. The expenditure needful to secure it would, the Lieutenant-Governor states, " absorb all the funds we " are likely to have available for some time to come." These funds, we feel sure, could not possibly be more usefully expended in the interests of the health of the people of the province.

8. An examination of Annual Form No. II., extending over 83 pages, leads us to ask whether it is worth the time and labour expended in its preparation and the cost of printing. For some of the districts the important column headed "Measures taken for sanitary improvement of Circle" is entirely blank. We may quote as examples the districts of Lahore, Jullundur, Gurdaspur, and Peshawar. Under the heading of "Principal Defects of Circle in Water-supply" we find for an entire district the one word "None" recorded. As examples we may mention the districts of Dera Ismail Khan and Gurdaspur. It is nearly the same with regard to the remarks on "Drainage" and " Domestic cleansing and Conservancy." Very different, however, is the "Statement showing the " Conditions of Municipal Towns as regards Water-supply and Drainage in the 1st, 2nd, and " 3rd Circles, Building and Roads Branch, Punjab Public Works Department." The information given in this statement is evidently carefully collected and might be turned to useful account.

19th July 1897.

No. 5.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1895.

This Report is of a somewhat meagre and fragmentary nature. Of the ten sections into which the prescribed form of sanitary report is divided, only Sections V. and VI., relating to Vital Statistics and Chief Diseases, are dealt with in anything approaching to adequate completeness. The general history of vaccination is given in a separate report. Regarding the climatic features of the year no remark is made. The section on sanitary works is entirely devoted to a statement of the sums of money expended on these works. Of the 39 pages of which the report consists, excluding the appendices, no fewer than 25 are entirely covered by tabular statements, and of the remainder many are to a large extent similarly filled up. Consequently we are mostly dependent on the resolutions by the Chief Commissioner for an account of the sanitary and vaccination work of the year.

2. *Vital Statistics.*—To Lower Burma only, with a population according to last census of 4,516,599, do the remarks on vital statistics and chief diseases refer. Into Upper Burma, excepting in the case of four towns, registration of births and deaths does not appear to have yet been introduced. During the past year the number of *births* registered exceeded those of the previous year by 6,394, and was equal to a ratio per thousand of population of 29·04, as compared with 27·62 in 1894. The ratio was the highest hitherto recorded. In paragraph 5 of the report the provincial birth-rate is shown for the past 24 years. In 1872 the recorded rate was only 17·79, and even so recently as

1891 was only 20·74; but since the latter year there has been marked improvement in registration. The system of registration in force in Burma is described in the Appendix to the Report. The duty of reporting births and deaths is imposed on the headman of a village, and the collection of records on the police. If both agents acted up to the instructions issued for their guidance, the registration of vital statistics in Burma would soon cease to be characterized as the "worst in India." But unfortunately neither the headmen nor the police appear to carry out this part of their duties with much efficiency. In one village in which the headman had recorded only 10 births during the year, the Civil Surgeon saw at least 50 children under one year of age. The same Civil Surgeon when on tour in the Pegu district, discovered that 1,072 birth and 864 death foils, collected from village headmen by the police, had not reached the Deputy Commissioner's office. What strikes us as a weak point in the rules is the want of some definite arrangement for the charge of the village register during the occasional absences of the headman. He is ordered when he leaves his village to deposit the foils already collected with a village elder or some other responsible person, who will make them over to the police if they should call during his absence. It is left to each headman to make his own arrangements as to the custody of the register, and also, it may be concluded, for the entry in it of any births or deaths occurring in the village before his return. The agent he selects might or might not fulfil the headman's instructions. Unless he were paid, or under some authoritative obligation to do so, it is improbable that he would trouble himself much about the duty entrusted to him. The result would be that some of the births or deaths would probably go unrecorded, or the foils remain undelivered to the police when the latter visited the village. The police, on the other hand, being paid and under discipline, neglect of their duties in connection with the collection of the foils of births and deaths could be dealt with in a way calculated to impress them with the need for exercising proper care. The Chief Commissioner says it is hardly necessary to point out that ample powers have been conferred by law to punish persons who neglect to report births and deaths as well as those who neglect the duty of registering and transmitting such reports.

3. The number of registered *deaths* fell from a ratio of 23·56 per 1,000 of population in 1894 to a ratio of 22·40 in the year under report. It is admitted that the general average for the province can hardly be regarded as even approximately correct. Confining our examination to a statement, covering nearly ten pages, "showing the number of births and deaths registered during the year 1895 "in those circles in which experience has shown that the returns are compiled with some approach to "regularity, and that the figures are on the whole fairly reliable," we find the recorded number of deaths varying from zero in Kyao to 106·94 in Pyingyè. In the same statement birth ratios of from 5·62 to 97·03 are met with. We agree with the remarks made by the Chief Commissioner regarding the value of this statement, when he writes:—"The grounds for the opinion of the district officers "that registration is less faulty in these 'selected' circles than in the province generally are not "stated, and in most cases are difficult to understand. The Officiating Chief Commissioner does not "think that any advantage is gained by the preparation of such a statement as that printed on pages "2 to 11 of the report." With the object of improving the registration of deaths in towns, a proposal was submitted by the Sanitary Commissioner to the effect that a certificate of registration should be required before bodies are permitted to be buried or cremated. Doubtless this would be an effectual means of bringing about improvement in registration, but if it tended to delay the burial or cremation of the dead, as seems likely, the improvement might be purchased at too great a cost to the public health. The Government of India call attention to the absence of all mention of the infliction of fines by municipalities for neglect to report births and deaths. Unquestionably there are in Burma special difficulties in the way of effecting accurate registration of vital statistics, but if supervision were more strict and constant, improvement would follow, as it has been found to follow such supervision in the provinces of India. Their knowledge and opportunities specially fit officers of the medical and vaccination establishments for efficiently assisting the other district officials in supervising and checking registration.

4. *Chief Diseases.—Cholera* caused, according to the returns, 5,150 deaths, as compared with 7,428 in the previous year. The disease prevailed in all districts, and from most of the divisions of the province was absent during no month of the year. The Sanitary Commissioner cautions us against probable error in diagnosis on the part of the ignorant agents entrusted with registration. He gives instances in which outbreaks of cholera were reported, which on inquiry by medical men were found to have no existence in fact; and he justly regards with scepticism the dates and localities assigned to the appearance of first cases in the rural parts of the province. There are other provinces besides Burma on the cholera returns from which just as little reliance can be placed as regards the dates assigned to first cases of the disease. It is certain that mild cases of cholera are frequently reported as cases of diarrhœa or dysentery, and equally certain that when the disease has once been recognised and reported as prevalent in any locality, nearly every form of bowel complaint is thereupon frequently returned as cholera. The Sanitary Commissioner writes:—"Several medical officers "in reporting on cholera, declare their inability to say whether the disease was, or was not, imported. "It is a significant fact, however, that cholera had broken out in several towns during the hottest "months of the year, just before the setting in of the rains, when scarcity of water was most felt, "owing to wells running dry and yielding muddy water."

5. *Small-pox.*—The number of deaths attributed to this disease during the year was 1,540, or ·34 per 1,000 of population. Of these deaths 890 occurred amongst children under 12 years of age; and of this number 348 were under one year of age. The backwardness of vaccination amongst infants, which may be deduced from these figures, is further shown by an examination of the returns in the Separate Vaccination Report. The recorded number of births in Lower Burma in 1895 was 131,147; and deducting from these the number of deaths which occurred amongst children under

one year of age, there remained available for vaccination 109,158. But the number of children under one year of age who were vaccinated during the season 1895–96 was only 41,107, leaving unprotected against small-pox 68,051. Until, therefore, the number of infants annually vaccinated approaches more nearly than at present the number available for vaccination, a high proportion of the deaths from small-pox may be expected to continue to occur amongst young children. Rapid progress in the extension of vaccination is, however, taking place. Within the last four years the number of successful cases of primary vaccination in Lower Burma has nearly doubled, having increased from 101,540 in 1892–93 to 196,536 in 1895–96; and the proportion of successful cases per 1,000 of population from 25·79 in the former season to 44·89 in the latter. Progress has been scarcely less satisfactory in Upper Burma. Accompanying the increase in the numbers vaccinated, an increase in the percentage of successful cases in primary vaccination is a satisfactory feature of the returns. This percentage is now 91·2. On the other hand, the number as well as the percentage of successful cases of re-vaccination has diminished. As the Chief Commissioner correctly observes:—"A falling-off in "re-vaccinations, properly so called, is no matter for regret. It is desired that vaccinators should, as "far as possible, confine their energies to primary operations until they have overtaken the annual "increase of the population by births, and this goal is far ahead except in the large towns."

6. *Fevers* are credited with having caused 48,049 deaths out of a total from all causes of 106,407. Excepting during the preceding two years this is the highest number of deaths from fevers on record. It should not, however, be lost sight of that the annual increase of the population of Burma, which during the ten years between 1881 and 1891 amounted to 22 per 1,000, would to an appreciable extent account for the greater number of deaths from fevers as well as from other diseases. There can likewise be no doubt that, owing to greater attention to registration, more deaths are recorded in recent years from all causes, fevers included, than in former years. An examination of the table given in paragraph 5 of the Report shows a rise in the recorded number of deaths from 33,239 in 1872 to 106,407 in 1894. An increase by which the deaths have been more than trebled could hardly have been due to greater unhealthiness of the province, and was more probably the result of greater care in recording deaths, as well as to an increase of these proportionate to the growth of the population since 1872.

7. The mortality from *diarrhœa and dysentery* was the highest on record. This, however, the Sanitary Commissioner attributes, not to the unhealthiness of the season, "but to more accurate "classification." The causes which we have suggested to account for the increased number of deaths recorded as due to fevers must also have contributed to a similar increase in the recorded number of deaths from diarrhœa and dysentery.

8. *Sanitary works.*—Some 20 lakhs of rupees were expended during the year on "works designed "directly or indirectly for the maintenance and improvement of the public health;" but no sanitary work of first-class importance was undertaken. Schemes for providing the towns of Moulmein and Mandalay with water supplies have been prepared, and the question of providing the funds necessary for their execution is under consideration.

19th July 1897.

No. 6.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Central Provinces for 1895.

The masterly analysis to which the report has been subjected in the Chief Commissioner's Resolution leaves little for us to add. From a climatic point of view the year was healthier than its predecessor, a result credited to deficient rainfall and consequent decrease in the fatality of fever. But if the deficiency of rain was conducive to lessened fever prevalence, it was, on the other hand, the cause of scarcity of good drinking water, and the concomitant diseases of such scarcity, cholera and bowel complaints. A series of bad or poor harvests during preceding years was followed in 1894, and in the cold weather of 1894–95, by still worse. "Thus," writes the Secretary to the Chief Commissioner, "the mass of the population over a large part of the province suffered during "the year 1895 from want of food, or eked out a subsistence with inferior and unwholesome articles "of diet." What, therefore, from a climatic point of view, should have been a healthy season, became, under the pressure of a deficiency of wholesome food, a season of great mortality. A year, such as 1894 was, of exceptionally great mortality is usually followed by one of low mortality, partly, no doubt, because such a year proves fatal to a large proportion of the very young, the very old, and the constitutionally feeble, and thus weeds the population of those least capable of resisting disease. But, according to the Sanitary Commissioner, "excluding the effects of epidemic influenza, "and allowing for the lessened fatality from fevers, it is certain that last year was even yet more "unhealthy than its predecessor, and therefore the worst of any year, excepting 1889, within the "last 10."

2. *Vital statistics.*—The *birth-rate* was the lowest recorded within the last 15 years, and was only 33·41 per 1,000 of population as compared with 38·82 in the preceding year. Excepting in four out of the 18 districts, a decrease in the number of births was noted. That the decrease was a real

one, and not due to a falling-off in registration, is beyond question. The sickness and mortality accompanying the privations of 1894 doubtless produced their usual effects in diminishing the fecundity of the people during the year following. To such an extent was this the case that the excess of births over deaths, which in ordinary years is normal, was converted into an excess of deaths over births. Whilst the birth-rate was 33·41, the death-rate was 36·75 per 1,000 of population; and, as predicted by the Chief Commissioner, "it is to be feared that the current year "(1896) will likewise show a falling-off in births, the series of bad harvests not having yet been "broken by a cycle of prosperity." Saugor district may be taken as an example of the influence which the unfavourable conditions described exercise on fecundity. In this district less than half the number of births were registered in 1895 that were registered in 1894. Without doubt defective registration is to some extent accountable for this deficiency of recorded births. During seasons of excessive sickness the village watchmen suffer like their neighbours, and those living in distant villages are frequently unable from sickness to make their periodical visits to the police stations for the purpose of reporting the occurrence of births and deaths.

3. As usual, fewer *deaths* than births escaped registration, and this might to some degree explain the excess of deaths over births; but the reduction of the vitality of the population, owing to hard times, acting in the direction of reduction of number of births, and the greater prevalence of disease acting in the direction of increase of deaths, were mainly accountable for this abnormal result. Figures are given to show that, even when domestic occurrences were duly reported by the village watchmen, these, in a considerable number of cases, failed to be entered in the register owing to the carelessness of the clerk at the police station. The employment of Superintendents of Vaccination for the check of the village watchmen's registers has also led to the discovery of many unrecorded births and deaths. As the outcome of such examination, it appears that nearly twice as many births failed to be registered as deaths.

4. *Chief Diseases.*—The deaths from *cholera* were more more than double the number recorded in the preceding year, and were equal to a ratio, per 1,000 of population, of 1·63 as compared with a ratio of 1·56 for the previous five years. The disease prevailed in every district and in every month of the year. Some of the Civil Surgeons give evidence to show that cholera was imported into their districts. As usual, the evidence is inexact or incomplete, as, in the conditions under which it is obtained, it must ordinarily be. Five jails reported cases during the year. In these, if anywhere, the exact facts should be available; yet in none of the cases could importation be traced. In two of the jails, only a single case occurred in each. In one of these the prisoner had been five and a half months in jail, and had enjoyed excellent health up to the date of his seizure by cholera; in the other the prisoner had been five months in jail, and was employed at the time of his seizure as an attendant upon a patient in hospital. In the former case, "the exact mode in which it "(cholera) obtained admission was not discovered." In the latter, the Civil Surgeon thinks "the "disease was probably imported in food"; but he gives no evidence in support of this suggestion. In the other three jails in which the disease appeared, the remarks are respectively, "no connection "with previous cases outside could be traced"; "the Civil Surgeon is unable to say how the "infection was introduced"; and "the disease is supposed to have been introduced from outside, "but how exactly is not shown." We have thus five groups of people under the constant observation of scientific experts, and yet cholera appears in each group without its having been found possible to trace the cause of its appearance. We may well hesitate, therefore, to accept the confident assertions made regarding the importation of the disease into villages or into fairs, such assertions resting in most cases on statements obtained from ignorant villagers or village watchmen.

5. Mr. Hankin's plan of disinfecting wells with permanganate of potash was carried out at various places on the appearance of cholera. Regarding these experiments Dr. Newman says:—"Before "accepting the efficacy of the permanganate of potash process, we should have the facts established, "that the poison was present in some particular source of drinking water; that the people using "that water and in consequence of doing so were attacked by the disease; and that on addition "of the remedy the infection was destroyed. No such complete chain of proof has so far been "produced."

6. *Small-pox* was unusually prevalent, and accounted for 6,644 deaths—equal to a ratio, per 1,000 of population, of 0·70 as compared with 0·15, the average for the previous five years. As usual, children under one year of age suffered severely; amongst them, 2,019 deaths occurred. Yet, if we refer to the Report on Vaccination for 1895–96, we do not find that infant vaccination has been neglected. Of the total number vaccinated, 209,137 were children under one year of age: the registered births for 1895 numbered 317,432; and deducting from this number 97,583 deaths of infants under one year, there remained available for vaccination 219,849. The unvaccinated residue consequently numbered only 10,532; and during a season of privation and sickness it is more than probable that the health of a majority of these unfitted them for undergoing vaccination. In view of the decrease in the number of births and of the prevailing unhealthiness of 1895, a decrease in the number of vaccinations was only what might have been expected. The falling-off amounted to 31,379 cases, excluding the Feudatory States. In these latter there was a considerable increase. The recorded percentage of success attained in primary vaccination was 95·88. It is suggestive that, as the result of their inspection of the season's work, Civil Surgeons found of the cases examined by them only 87·62 per cent. to be successful. Animal lymph was exclusively used in some districts; whilst in others humanized lymph was mostly employed. Selecting one of the former, Narsinghpur, for comparison with one of the latter, Sambalpur, it would not appear that animal lymph always gave so high a percentage of successful cases as humanized lymph. According to Statement I., only

96·77 per cent. of the operations in primary vaccination were successful in Narsinghpur; whilst in Sambalpur 99·00 were successful. The latter percentage is, however, suspiciously high.

7. *Fevers*, although less fatal than during the preceding year, accounted for nearly two-thirds of the total number of deaths. A very instructive table, on page 24 of the Report, gives the ratios of deaths from fevers and other diseases, founded on the inquiries made by the Civil Surgeons, and contrasts them with the ratios given by the police in nearly an equal number of cases. The general result is that, whilst of 15,194 deaths Civil Surgeons found a ratio of 49·03 due to fever, the police found of 15,387 deaths a ratio of 59·98 due to the same cause. As might have been anticipated, in the great majority of districts the proportion of deaths ascribed to fever by the police was higher than the proportion so ascribed by Civil Surgeons; but in a few districts, such for example as Balaghat and Sambalpur, it was otherwise, and the proportion was equal to, or less than, that resulting from the inquiries of the Civil Surgeons. Regarding the 10 cases of enteric fever diagnosed in the Nagpur jail, Dr. Newman writes:—"Careful inquiry failed to trace any certain origin to the "disease in the conditions under which the prisoners were placed, or in their food supplies. The "drinking water, which is obtained from the Ambajheri Reservoir, was examined by Mr. Hankin, "who reported that he has found in it a bacillus 'resembling the typhoid bacillus,' but the same "water is used by nearly the entire population of Nagpur, by all the European residents, by the "many children in the numerous schools, and outside the jail only a few cases were seen. Had the "water been the cause, very many more people would almost certainly have been affected."

8. The poverty and hardship from which the people suffered, as the consequence of a succession of bad harvests, tended largely to raise the death rate from *diarrhœa* and *dysentery*. But, high as the recorded death-rate from these diseases is, it is certain that it is much under-stated. One Civil Surgeon remarks that the people seldom admit dysentery as the cause of death, and another says that many cases occur that are not shown in the registers. Both are, in Dr. Newman's opinion, correct.

9. "The larger *sanitary works* undertaken, or in progress, during the year are, as usual, all in "connection with the water-supply." Important as the provision of an abundant supply of pure water is for the towns, of scarcely less importance is its complement, a drainage system for the removal of the water when it has fulfilled its uses. Both of the chief cities of the province are provided with water services, but neither has as yet been able to find the funds necessary for carrying out drainage works. The cities of Bombay and Calcutta furnish examples of the disastrous consequences arising from the introduction of water into a town without suitable provision being made for its removal. In both cities the soil has become water and sewage logged to a degree which goes a long way towards neutralizing the beneficial effects on health of a supply of pure water.

19th July 1897.

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for the year 1895.

1. Although, in accordance with instructions, the inclusion in the report of the statement comparing the fluctuations of weather, of prices of food-grains, and of death-rates has been discontinued, it was not intended, as the Government of India point out, that the matter should be lost sight of in the Annual Sanitary Reports; and we are glad to see the request made that in future this subject may be discussed in the body of the report. Except that the monthly rainfall is shown in the tables recording the monthly mortality from cholera in each district, the climatic conditions which prevailed in the province during the year are not touched upon. Judged of from its vital statistics, 1895 was not so healthy as its predecessor.

2. *Vital Statistics.*—Whilst the *birth-rate* fell from 31·10 in 1894 to 31·00 in the year under report, the *death-rate* rose from 30·69 in the former to 33·72 in the latter. We have an opportunity in this report of comparing the results of registration of births and deaths carried out in several different ways. *Firstly*, in the Surma Valley districts, with a census population of 2,522,135, births and deaths are reported by paid village chaukidars. This system seems to be identical with that in force in the North-Western Provinces and elsewhere. In the Surma Valley the ratio of births thus recorded, per 1,000 of population, was 33·74; that of deaths 33·62. *Secondly*, in the Brahmaputra Valley districts, with a census population of 2,449,782, births and deaths are reported by unpaid *gaonburas*, with the result that the ratio of registered births was only 28·47, and of deaths 28·40. *Thirdly*, in nine sadr and 11 sub-divisional towns, with an aggregate population of 105,431, registration of births and deaths is compulsory. In these sadr towns the ratio of registered births, per 1,000 of population, was 20·80, and in sub-divisional towns 31·20; whilst the ratio of recorded deaths in the former was 28·87, and in the latter 43·47; dispensary deaths being excluded in both cases. *Fourthly*, in the hilly parts of the province, with a population of 455,749, registration was not carried out, excepting in certain selected areas with an aggregate population of 49,167. The ratios of births and deaths in these selected areas were, of the former, 25·79; and of the latter, 22·76. Obviously, the best results were obtained in the Surma Valley, where vital statistics are reported by paid village chaukidars. It might have been anticipated that in the 20 towns in which registration was compulsory, and taking into account the greater intelligence of their inhabitants as compared

with the rural population, the best results would have been attained; but in all except five of these towns the results were more unsatisfactory than in rural tracts were registration is not compulsory. The comparison between the different methods of collecting vital statistics in Assam would seem to suggest that, as far as practicable, the agents found to be most efficient, the paid village chaukidars, should be generally employed in the work of reporting births and deaths. Regarding the combined results obtained by the different methods described, Dr. Stephen remarks:—"There is little doubt "that in 1895 not less than 30 per cent. of the births in this province were not registered." As usual, deaths have been more accurately recorded than births; but even of these the Chief Commissioner, in his review of the report, estimates that about 19 per cent. escape registration. The normal birth and death rates of the province are estimated at 48 and 42 per 1,000 of the population respectively.

3. Dr. Stephen points out that the ratio of male to female births recorded affords some indication of the accuracy or inaccuracy of the registration. For example, in the Surma Valley, where registration, as we have shown, is carried out with comparatively greater accuracy than in other parts of the province, the ratio of recorded male to female births was 106 of the former to 100 of the latter. In the Brahmaputra Valley, on the other hand, where registration is most defective, the ratio of male to female children born was 109 of the former to 100 of the latter. This divergence in the proportion of male to female children born has been observed in other provinces to increase, as a general rule, with the inaccuracy of the registration—the greater the divergence, the more defective the registration.

4. Taking into account the ignorance of the agents employed in the collection of vital statistics and the fact that many of them are unpaid, approximate accuracy in the registration of births and deaths is all that need be looked for. Even this cannot as yet be said to have been attained; although with the object of impressing upon them the need for greater care, no fewer than 1,211 chaukidars and *gaonburas* were punished for neglecting to report births and deaths during the year, in addition to 192 persons prosecuted "for failing to report vital occurrences" in the circles in which registration was compulsory. Besides this, "in order to draw the attention of district officers "to defects in the returns furnished, when the monthly returns of vital statistics showed results very "much at variance with those of the corresponding month of the previous year, statements were sent "to them comparing the numbers furnished for the registration circles in question for the two years, "with the request that the matter might be inquired into, and that, if the differences were found to "be due to defective registration, corrected returns might be furnished." This appears to us to be "a more practical way of dealing with defects of registration than the publication of pages upon pages of figures showing the numbers of births and deaths recorded in each individual registration circle of a province, in the hope that the district officers may find time to examine the returns for the different circles and pass orders on them when they appear to be inaccurate. With such figures, in the previous year's report for the North-Western Provinces, no fewer than 159 pages were covered. The time and labour spent in the preparation of these returns for Bengal have not unnaturally drawn a remonstrance from the Sanitary Commissioner of that Province in his Annual Report for 1895. Another, and perhaps the most effectual of the means taken to improve registration, is inspection of the registers by police officers. In this work of inspection, assistance might be given by Civil Surgeons whilst on tour, and by the vaccination staff. A house-to-house examination only will definitely show whether the entries in the registers correspond with the births and deaths which have actually occurred. Dr. Stephen gives in his report short statements of the ratios of births and deaths from the statistics of other provinces for comparison with those of Assam. Such comparisons are very useful and might be made more frequently in the sanitary reports for other provinces.

5. *Chief Diseases.*—Although *cholera* was more fatal than during the preceding year, the number of deaths caused by it was less than the average for the five-year period 1889–93. The disease prevailed during each of the 12 months, and no district was exempt from it during the year. In some of the districts, such as Kamrup and Darrang, the death-rate from cholera was very high, a ratio of 8·14 having been recorded in the former, and of 6·73 in the latter, as against an average ratio, per 1,000 of population, of 3·78 for the province as a whole. In sadr towns the average ratio was higher than the provincial average, having been 5·36 as compared with 3·78 for the latter. In some of the towns this average was greatly exceeded. In the town of Tezpur the ratio of deaths was 13·46, and in Dibrugarh 10·63. The Sanitary Commissioner writes: "As cholera does not appear in "epidemic form in places in which the water-supply is properly protected, this high death-rate "shows that much remains to be done in the way of providing a protected water-supply for the "sadr towns of the province." Judged by this rule, it is feared that there is, as yet, no town in India with a properly protected water-supply, seeing that there is none which can be shown to be exempt from epidemic cholera. Even when measures are taken to provide a pure water-supply, Dr. Stephen gives instances in which the people perversely refuse to use it, and persist in taking water from sources known to be impure. The statement made regarding the greater prevalence of cholera in tea gardens hardly seems to bear out the conclusion that cholera prevalence varies directly as the purity or impurity of the water-supply: "The arrangements for protecting the "water-supply of many tea gardens are very efficient, and in almost all cases they are much more "efficient than the arrangements in villages, and as the other sanitary arrangements in tea gardens "are distinctly better than they are in rural tracts, the cholera rate ought to be lower in tea "gardens than it is amongst the rest of the civil population." The Sanitary Commissioner suggests a theory for the explanation of this refusal of cholera to fit in with the assertion that the disease does not appear in epidemic form in places in which the water-supply is properly protected. "The

" excessive death-rates from cholera in the gardens," he says, "is probably due to the fact that " the disease is at times introduced into gardens by recently imported coolies." Those responsible for the sanitary arrangements connected with the transport of coolies from the districts in which they are recruited to the tea gardens, might be able to estimate the weight which should be attached to this probability.

6. Anti-cholera inoculations were carried out on an extensive scale by Dr. Haffkine amongst tea garden coolies. Out of 28,950 of these, 7,507 were inoculated by Dr. Haffkine. The results show that amongst inoculated and non-inoculated the proportion of attacks by cholera of the former was 8 to 11·5 of the latter; and of deaths 3·73 of inoculated to 7·0 of non-inoculated. "As there is " reason to believe," writes Dr. Stephen, "that cholera is at times introduced into Assam by " tea garden coolies coming by steamer from Bengal, it seems to be desirable that arrangements " should be made for having all tea garden coolies protected by anti-cholera inoculation before they " are put on board the river steamers." In Appendix C., Dr. Hare gives an interesting account of his anti-cholera inoculations. Out of a gang of Khasi coolies who arrived at Dibrugarh on the 16th of October, he inoculated 196, leaving 159 uninoculated. Of the inoculated only four were attacked, all of whom died; of the non-inoculated 34 were attacked and 30 died. The attacks were thus, in the proportion of 2·04 per cent. of the inoculated, and 21·38 of the non-inoculated; whilst the deaths of the former were in the proportion of 2·04 per cent., and of the latter 18·86. Dr. Hare concludes: "I believe the above observations on the Khasi coolies to be unique." A feature in these figures which may strike some is the different effect which vaccination or inoculation against small-pox produces. Persons vaccinated or inoculated rarely die when attacked by small-pox; the disease when it appears in them generally does so in a mild or modified form. Not so in the case of anti-cholera inoculation; of the only four inoculated coolies who were attacked by cholera, all died.

7. *Small-pox and Vaccination.*—Although the mortality from small-pox was somewhat less than in the preceding year, it was much above the average for the five-year period, 1889–93. The ratio of small-pox deaths for the province as a whole, was in the year under report 0·77 per 1,000 of population; but this was far below the ratio for both sadr and sub-divisional towns. In sadr towns the ratio was 1·93, and in sub-divisional towns 11·00. Of the former, Dibrugarh records a ratio of 11·64 deaths, and of the latter Barpeta a ratio of no less than 36·43 deaths. The Sanitary Commissioner writes: "As noted in former reports there appears to be little relation between the " death-rates from small-pox in the several districts, and the amount of protection afforded in them " by successful vaccination." Yet, a reference to the Report on Vaccination shows that 42·97 per 1,000 of the population of the province were successfully vaccinated during the year, or greatly more than the recorded ratio of births, which latter was only 3·10. When, however, the number of children under one year of age who were vaccinated is compared with the number available for vaccination, it is at once evident that infant vaccination is the weak point in this season's, as in previous seasons', work. From Statement I it is seen that the number of children under one year of age who were successfully vaccinated in 1895–96 was 45,907; whilst the number of recorded births for 1895 was 155,631. Deducting from the latter 32,253 deaths of children under one year of age, there remained available for vaccination 123,378, and of these only 45,907 were protected against small-pox. It is thus clear that there is no lack of susceptible subjects when small-pox breaks out in the province. But although in some parts the people still obstinately refuse to have their children vaccinated, rapid progress is, on the whole, being made by the Department. The total number of persons vaccinated during the year by all agencies was 260,690, which exceeds the number for the preceding year by no fewer than 65,553; whilst the percentage of successful cases rose from 87·80 in 1894–95 to 97·74 in the year under report.

8. *Fevers* were more fatal than during the preceding year, and were credited with 92,359 deaths, equal to a ratio per 1,000 of population of 18·39, as compared with 16·95 in 1894, and with 15·75 the average for the five years 1889–93. The experiment of distributing quinine through post offices is being persevered with; but "there is not at present sufficient material to enable the Chief " Commissioner to decide definitely whether the scheme will ultimately be successful." It is added that steady progress is being made, and the Chief Commissioner proposes to sanction the extension of the system to all post offices in Assam. Deaths from *kala azar* are included in the list of deaths from fever. There were 15,894 deaths from this disease reported in 1895, as compared with 13,164 in the preceding year. Of the former number no fewer than 11,037 deaths occurred in the Nowgong district; but good reasons are given for the belief that a considerable proportion of the cases returned as *kala azar* in this district were due to ordinary malarial fever. We would like to see some explanation of the gradual decrease of this disease in some parts of the country in which it has been prevalent, and its invasion of new parts. Whether *kala azar* is due, as some assert, to the presence in the intestines of a parasite, the *anchylostomum-duodenale*, seems doubtful, seeing that this parasite has been repeatedly discovered in the intestines of persons in apparently sound health and who have not suffered from *kala azar*, whilst, on the other hand, its presence in the intestines of persons dying from *kala azar* has not been found to be constant. This question needs further investigation, and a medical officer has been appointed with a view to the systematic and continuous observation of the disease.

9. *Sanitary Works.*—As stated in the Government review of the Report, "no sanitary work " of any special importance was completed during the year, but considerable progress was made in " improving the water-supply and conservancy of the sadr and sub-divisional towns of the province." There are, however, as yet, only two towns in the province provided with a water-supply delivered

from filter-beds through pipes. The defective registration of vital statistics in these two towns makes it impossible to arrive at any certain conclusion as to the influence which the pure water-supply has had in diminishing the death-rate.

10. At one of the two meetings of the Sanitary Board held during the year, the question of village sanitation was considered. The Board came to the conclusion, wisely we think, that any legislation which might be undertaken regarding rural sanitation should be of the simplest character.

19th July 1897.

No. 8.

Memorandum by the Army Sanitary Commission on the Rajputana Sanitary Vaccination Dispensary and Jail Report for 1895.

Although, in the Ajmere district, the rainfall was some three inches above the average of the previous six years, in Merwara it was more than five inches below the average, and also considerably below it in the Native States. As the population of the Ajmere district is only 422,359, out of a total of 11,464,756 for the Ajmere-Merwara province and the Native States combined, it is evident that this deficiency of rain during the year affected all but a small portion of the country dealt with in the Report. In the south and east of Rajputana, the Agent writes, "there were no cold weather "rains, and the crops were consequently inferior; but, although the prices of grain rose in consequence, no serious scarcity was felt in the States concerned." He adds: "In the Western States "the rainfall was very scanty, and the tanks in the districts were mostly low or dry. Cattle from Jaisalmir were driven into Sind or towards Malwa in search of pasture and water." The serious consequences of drought have since then become more fully manifest; and the more remote effects on fecundity and mortality will doubtless be apparent in the vital statistics of the next and following years.

2. *Vital Statistics.*—In Ajmere-Merwara the *birth-rate* rose from a ratio of 32·23 in 1894, to a ratio of 35·29 in the year under report. This increase is credited partly to improved registration. An examination of Annual Form I will show that there is still much room for further improvement. The proportion of male to female children recorded to have been born in the province as a whole was 115·42 of the former to 100 of the latter. In two rural circles the recorded proportions are 135·20 and 136·65. In one town we find the proportion put at the extraordinary rate of 166·67 male to 100 female children. Such ratios witness to the defective state of registration. The *deaths* were fewer than during the preceding year by over 2,000; and the ratio per 1,000 of population fell from 31·02 to 26·95. As in the case of births, so with deaths, the recorded ratios are in some cases so low as to lead to the conviction that a large proportion of them failed to be registered. In two circles the ratio per 1,000 of population is a little over 18, and in another a little over 17. Whilst in the Ajmere-Merwara province vital statistics are as yet so defective, it is no wonder to find them in the Native States as a whole altogether unreliable. The recorded ratio of births for these States is only 16·75 per 1,000 of population, and of deaths only 13·66. In some of them registration is little more than a name. In two States the ratios of recorded births are only 2·18 and 7·89 respectively; whilst in two, the death ratios are only 2·20 and 4·99. Except for the purpose of indicating the backwardness of registration such statistics are obviously useless.

3. *Chief Diseases.*—In Ajmere-Merwara the deaths from *cholera* numbered 289, and in the Native States 1,049. In the preceding year Rajputana was practically free from cholera. The Administrative Medical Officer considers that the disease, in two or three outbreaks, was "clearly traceable" to the fair annually held at Pushkar:—"Almost all the persons who suffered in the city "of Ajmere had been to the same fair," whilst 12 cases occurred in the place itself. Again, it is stated that in November an outbreak occurred at Jodhpore, Nawa, Didwana, and Nagore, and that in nearly all cases it was confined to pilgrims from Pushkar. The fair is held in the month of November, a time of the year when cholera is generally in comparative abeyance. It is an important step to have traced the disease to this fair as its point of departure. If, as the Sanitary Commissioner of the North-Western Provinces and Oudh assumes, sanitary measures have proved equal to the prevention of cholera at the vastly greater gatherings of pilgrims at Hardwar in the month of April, a season of the year when the disease is more liable to become active, there should be less difficulty in preventing outbreaks at Pushkar, where the number of pilgrims is smaller and the season when the fair is held less favourable to its development and spread. At any rate, if the disease is preventible, as it is now usually held to be, Pushkar fair might afford an opportunity of demonstrating the truth of this conviction:—"Outbreaks of cholera, although every Sanitary pre-"caution is taken, constantly occur after the great November fair at Pushkar." Dr. Hendley himself thinks the facts attending the outbreaks of cholera in Rajputana in 1895 "point to the possibility of prevention." We trust he will not fail to put this question of preventibility to a convincing test.

4. *Small-pox* was credited with 754 deaths in the province of Ajmere-Merwara, or a ratio of 1·39 per 1,000 of population, as compared with an average ratio of 1·12 during the previous five years. Regarding small-pox mortality in the Native States, there are no statistics available. Of the 754

persons who died of small-pox in Ajmere-Merwara 238, or about one-third, were infants under one year of age. Annual Statement I gives the number of children under one year successfully vaccinated to have been 10,056, whilst the number born was 19,138. Of the latter, 4,167 died before reaching one year of age, leaving 14,971 available for vaccination. Deducting from this latter number those successfully vaccinated, we have a residuum of 4,915 unprotected children. Until the number of infants annually vaccinated more nearly approaches the number born and available for vaccination, susceptible material for fatal outbreaks of small-pox will not be wanting. Yet vaccination is making progress; the number of primary vaccinations rose from 13,337 in 1894 to 15,583 in the year under report; and of these latter 96·24 per cent. were successful, as compared with 98·80 in the preceding year. To some it may come as a disappointment to find a decrease in the percentage of successful cases; but in this we do not share. We take the explanation to be that stricter supervision is exercised over the work of the vaccinators. Those who have had an extensive experience of vaccination in India can hardly avoid suspecting the accuracy of returns which record such ratios of success as those which stand against the names of the majority of the Native States. A reference to Annual Statement I will show that in these a record of upwards of 99 per cent. of successful cases is quite common.

5. To a decrease in mortality from *fever* the lower ratio of total deaths during the year was chiefly due. The sale of quinine at all Post Offices in Rajputana was continued throughout the year; but "so far the experiment has not been very successful." Dr. Hendley, however, thinks it always takes time for the people to understand the advantages of a measure of this kind, and advises that the experiment should be continued for a further period.

6. The Administrative Medical Officer says that the subject of sanitation in Rajputana cities has been gone into rather more minutely than usual for several reasons, one of which is to emphasise the difficulties which surround the sanitarian. He continues:—"It is encouraging to observe that, in "spite of what appears a superhuman undertaking, something is being done, and that we may hope "that by degrees a reasonable amount of cleanliness may be achieved. It is probable that a general "change of public opinion may begin from schools, in many of which the elements of sanitation are "being taught." Without doubt, permanent advance in sanitary improvements in these States need not be looked for unless it be supported by the voluntary effort of the people themselves. From this point of view education is more likely to have good results than legislation.

7. The health of the prisoners in the Ajmere jails shows a serious falling off during the past two years. The death-rate, which in 1893 was only 11·87 per 1,000 of strength, rose to 18·01 in 1894, and more than doubled in the year under report, when it reached 45·35. It is not satisfactory to learn that, "in January an epidemic broke out in the Ajmere jail, and continued until May 1895," and that "it did not attract special attention until the Administrative Medical Officer's inspection in September." It was the opinion of this officer that the disease was a jail disease, and probably of the nature of relapsing fever. The opportunity of making an exact diagnosis of the disease during the time of its prevalence was, however, missed.

8. In the jails of the Native States the death-rate was almost the same as during the preceding years. There was a decided and satisfactory decrease in the prevalence and fatality of respiratory diseases and bowel complaints. The over-crowding commented upon in our last Memorandum still continues in the Oodeypore jail, although the death-rate fell from 39·86 in 1894 to 28·74 in the year under report. It is surely inexcusable that "there is still much scurvy in the Jhallawar jail," unless the prisoners were suffering from the disease at the time of their reception into jail. "Progress," Dr. Hendley writes, "is continually made in the Native States in the construction and management "of their central jails, and some of the district prisons and lock-ups are being improved. Special "attention is now required to the latter."

9. The report on dispensaries calls for no special notice from us.

29th May 1897.

No. 9.

Memorandum by the Army Sanitary Commission on the Medical and Sanitary Report of Coorg for 1895.

Although there was no cholera, and only seven deaths from small-pox during 1895, yet the year cannot be described as having been healthy. The number of registered deaths exceeded by 506 the number of registered births. The rainfall, although greater than that of either of the two previous years, was less than the average. There was nothing in the meteorological character of the season which would satisfactorily account for the high death-rate. The price of rice was higher than it had been during either of the preceding five years, but that of *ragi* remained about the same.

2. The low *birth-rate* and the high *death-rate* are largely explained by the facts stated in the Chief Commissioner's review of the Sanitary Report. "It must always be borne in mind that large numbers of coolies (probably not less than 50,000) annually immigrate" into Coorg with a view to employment on the coffee estates. The influence which this annual influx must exercise on the vital

statistics of Coorg may be realised from the fact that the number of immigrants exceeds more than a fourth part of the entire population. The registered number of births during the year was 4,567, and of deaths 5,073. As many of the immigrants do not bring their women with them, the birth-rate, as the Civil Surgeon observes, must always be low. On the other hand, the coolies, "recruited from the poorer classes, are often ill-fed and ill-clad," with the result that the number of deaths which occur on the ghaut roads in Coorg amongst coolies coming up or going down to the coast "is little less than a scandal." Thus, whilst from the circumstance of the coolies being mostly males, the ratio of births to population is diminished, the conditions inimical to health under which they imigrate subject them to a heavy mortality, and the death-rate is increased.

3. The most serious question dealt with in the Report is how to put a stop to this great mortality amongst the immigrating coolies; and it is one in settling which no time should be lost, alike in the interest of the coolies and those who employ them. The Commissioner writes:—"In July of the "year under report a fund was started to provide shelters on these roads. Subscriptions up to "about Rs. 3,000 were provided, but although I wrote very strongly to Government pointing out "the absolute necessity of something being done in this matter, and asking for a grant to supplement "the subscriptions, I much regret that no money has yet been passed, and without a grant the "shelters cannot be built, and the loss of life must continue." But, fortunately, the Government of India have promptly come to the rescue, and have decided it to "be imperative that the coolies should be provided with shelter as soon as possible," and without waiting for the report of the Committee sitting to investigate the question.

4. An unusual feature in the vital statistics of this small province is the preponderance of births of female as compared with births of male children. Of the former, 2,287 were registered to only 2,280 of the latter. What the normal ratio of male to female births in India generally may be is not altogether certain; but it is extremely rare to find that the recorded number of males born in any province does not largely exceed the number of females born. The number of deaths of males, on the other hand, is, in Coorg, largely in excess of the number of deaths of females. What has already been stated regarding the immigration of coolies unaccompanied by their wives would to some extent explain this anomaly; but it is more than likely that these ratios are also, in part at least, due to defective registration.

5. The only disease which was unusually fatal was *fever*. Of the 5,073 total number of deaths during the year, no fewer than 3,814 were ascribed to this cause alone. This is equal to a ratio of 23·48 per 1,000 of population. In Coorg, as elsewhere, many deaths from other diseases are doubtless credited to fever; yet, even when allowance has been made for these, the sickness and mortality from this one cause must weigh heavily on the prosperity of the province. With a view of doing something towards ameliorating the condition of the sufferers from fever, we would warmly support the proposal of the Civil Surgeon to introduce the sale of quinine by the post offices where there are no dispensaries.

6. Although, during the year, small-pox was in abeyance and was but little prevalent in the preceding year, it would be a delusion to conclude therefrom that in succeeding years the disease will continue to deal so leniently with Coorg. An examination of the returns of vaccination shows that infant vaccination is very incomplete. Against 4,567 births there were only 1,188 vaccinations of children under one year of age. Even when the 1,167 children who died under one year are deducted, there remained available for vaccination 3,400; so that only a little over one-third of these were protected against small-pox. This large proportion of unprotected children provides the elements for a fatal outbreak of small-pox when next that disease revisits Coorg in epidemic form. Only so late as 1892, the records show that no fewer than 913 deaths, equal to a ratio of 5·27 per 1,000 of population, were caused by small-pox.

7. Neither the jail nor the dispensary report calls for special remark, but we may quote from the latter the following paragraph in confirmation of the accounts already given of the sad lot of the immigrant coolies:—"The Commissioner is taking steps to have shelters built on the principal ghaut "roads for the use of coolies entering and leaving the province, and towards which the planters have "already liberally subscribed. These are greatly needed, and, I hope will tend to reduce our high "mortality, for out of the 251 deaths in the two hospitals, no less than 208 were coolies from the "plains, and only 43 were residents of Coorg, many of the former dying within a few hours of their "admission."

8. In carrying out *sanitary works*, this small province is, at least, abreast of its greater neighbours. Already the largest town, Mercara, has provided itself with a pure water-supply; and the next largest, Virajendrapet, is raising the funds needful to enable it to follow its example. The water-supply at Mercara is said to be "very much appreciated by the people, and its success has made all the other small towns clamorous for similar schemes." It is not often that one hears of sanitary improvements in India being so readily and warmly appreciated.

29th May 1897.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1895.

The year was, on the whole, a healthy one. Except that the rainfall was considerably greater than the average for the preceding ten-year period, having been 49·40 against 44·92 inches, the meteorological features of 1895 did not differ much from those ordinarily prevailing. Although the prices of the principal food-grains were somewhat below the average for the preceding two years, they were still above the average for the 10 years ending 1892.

2. *Registration* is said to have received increased attention. This may have led to local improvement in the record of *births* and *deaths;* but when we find a birth-rate of 27·0, and a death-rate of only 18·2 per 1,000 of estimated population recorded for the Presidency as the outcome of this increased attention, we must conclude, either that the conditions of life in Madras differ remarkably from those obtaining in the adjoining provinces, or that the registration of vital statistics in the former is still greatly more backward than in the latter. In the Bombay Presidency the birth-rate for the same year was 35·83, and the death-rate 28·61; in the Central Provinces 33·41 and 35·75; and in Bengal 34·57 and 31·39. The death-rate in Madras is thus so low, that the inhabitants may count on living nearly twice as long as their neighbours in Bengal and the Central Provinces. The Sanitary Commissioner uses the figures of the "estimated" population of the Presidency in making his calculations, instead of the last census figures, on which ratios are calculated in other provinces; and this circumstance somewhat, although to no great extent, affects the results. The "estimated" population numbers may, or may not, more closely approximate to the actual numbers than those obtained by adding the excess of children born over the number of deaths since 1891 to the census figures of that year. It is probable that they are nearer the truth than the last census figures themselves; but however that may be, it is inconvenient for purposes of comparison to find one province adopting one method of calculating ratios of births and deaths, and the next province another method leading to differences in the result.

3. The birth-rate estimated by actuaries for the Presidency is from 42 to 52 per 1,000 of population, and in municipalities, 33·2, the nearest approach to these rates, is reached. Judged by this result, and the fact that penalties were inflicted in 633 cases for omission to register births and deaths, it may be acknowledged that some effort is being made in municipalities to improve registration.

4. As in the record of births, so in that of deaths, municipalities give the only results which can be regarded as having any approximation to probability. For these, the ratio of deaths per 1,000 of population was 28·9, in rural towns 18·9, and in villages 19·0. In some of the rural towns, such as those of Salem and Chingleput, the ratios recorded are only 9·0 and 7·7. The ratios for the villages in some of the districts are little better; in those of Ganjam the ratio given is 12·3, and in those of Malabar 14·6. Obviously, it is a waste of time to work out elaborate calculations on data so patently worthless.

5. Of the chief diseases, *cholera* was credited with 21,172 deaths, or almost exactly half the number caused by it in the preceding year. The disease was most fatal in the two districts of South Arcot and Tinivelli; and the Sanitary Commissioner states that both "have water-supplies liable to "contamination in a very marked degree." This is no doubt true; but, as remarked by the Government in their review of the Report, "the same argument might be applied to other districts." Although it is universally acknowledged that one of the most effectual protections against cholera is the provision of a pure water-supply, experience proves that it would be unsafe to trust to this alone, if other sanitary precautions are neglected. As the Health Officer of Bombay puts it:—"To believe, "as some do believe, that, with a plentiful and pure supply of water, there will be no more an epidemic of cholera is, in my opinion, to believe in a delusion.

6. *Small-pox and Vaccination.*—The mortality from small-pox during the year was greatly less than during any of the preceding three years, and equalled a ratio per 1,000 of estimated population of only 0·1, as compared with 0·9, the average for the previous five years. Of the 5,111 deaths from this disease, 1,111 occurred amongst children under one year of age. Turning to Statement No. I in the Appendix to the Report on Vaccination for 1895–95, we find that, of the 1,007,166 cases of successful primary vaccination, only 311,230 were amongst children under one year of age. The recorded number of children born alive during 1895, exclusive of Europeans and Eurasians, as shown in Statement I, Appendix D, of the Annual Sanitary Report, was 976,572. Of these, 162·3 per 1,000 of births are stated to have died before reaching their first year of age, leaving available for vaccination upwards of 800,000 children. As only 311,230, or less than half of these, were successfully vaccinated, it is obvious that infant vaccination in Madras is still very incomplete, and that it would be a delusion to found expectations of immunity from small-pox mortality in the future on a record of a low death-rate from the disease in the year under report. The large proportion of infants annually failing to be vaccinated in this Presidency is a danger, the gravity of which will force itself into notice when small-pox next appears, as it assuredly will appear, in epidemic form. It is not a little confusing, when extracting figures from the authorized forms appended to the Vaccination Report, to find that these do not always agree with the figures in the body of the Report. For example, in paragraph 5 of the Vaccination Report, a table is given, showing the "total vaccination work done by

" all agencies throughout the Madras Presidency " in 1895–96 as 1,120,625 primary vaccinations and 77,546 re-vaccinations. Statement No. I gives, of the former, the " Grand Total " to be 1,103,099, and of the latter 75,871. No doubt these figures can be reconciled; but it would have saved trouble had the discrepancy been explained. Again, a reference to the table in page 5 of the body of the Report gives the percentage of success in primary vaccination to be 93·0, and in re-vaccination 80·3; whilst in Statement No. I the figures are 87·0 for the former and 80·5 for the latter. If the ratios from the authorized statement are accepted, they show that, as the strictness of inspection of results increases, the percentage of successful cases diminishes. It is significant that the Inspector of Vaccination himself, and District Sanitary Officers, found only 79·6 of the cases examined by them to be successful, as compared with 91·8 and 92·5 reported by the Native Deputy Inspectors and Vaccinators. Dr. Bannerman writes:—" In 1893–94 the important step was begun of undertaking " the systematic inspection of the whole range of each Deputy Inspector, with the result of revealing " an amount of corruption beyond even what was expected to exist." He believes that, in consequence of the measures being adopted, " the department will gradually be purged of idlers and " cheats, and that its statistics will in time afford some indication of the actual condition of the " population in regard to its state of protection against small-pox."

7. Dr. Bannerman confirms the opinion expressed by us in our last Memorandum, regarding the use of vaccine lymph made into a paste with glycerine. Calf-to-arm and arm-to-arm vaccination always have given, and probably always will give the best results. Although there are circumstances under which preserved lymph must necessarily be used, these are exceptional and with suitable arrangements might almost disappear. The practice of arm-to-arm vaccination, or the use of humanized lymph at all, is condemned by the Madras Government. In paragraph 8 of the Government review we find:—" It appears from paragragh 23 of the Report that humanized lymph " has, notwithstanding the remarks made in paragraph 8 of General Orders, Nos. 1,388, 1,389 L, " dated 8th August 1895, again been used," and, farther on: " The Government trusts that effective " steps will be taken by the Inspector to put a complete end to this objectionable state of things." We would like to know the grounds upon which the use of humanized vaccine lymph is so uncompromisingly condemned in Madras, and whether these grounds rest on conditions peculiar to that Presidency. In the adjoining Presidency of Bombay, as well as in other provinces of India, the use of humanized lymph is still the rule, and the use of animal lymph the exception.

8. In paragraph 107 of his Report, the Sanitary Commissioner writes:—" With the prospect of " special increase of small-pox following introduction from other Presidencies, it remains to be seen " during 1896 how far Madras has been capable of resisting the invasion." The reader might gather from this, that risk to Madras lay in the greater prevalence of small-pox in the provinces surrounding it. But, as a matter of fact, the risk is all the other way. Taking the average of the previous five years, small-pox, as estimated by the deaths it caused, was five times more prevalent in the Madras Presidency than in Bengal, six times more than in the Central Provinces, and eight times more than in Bombay. If, therefore, we adopt the practical test of immunity from small-pox as the measure of the efficiency of vaccination, it follows that the position occupied by Madras in the comparison with its neighbours, is a somewhat humiliating one.

9. *Fevers* are credited with having caused 277,337 deaths, or 6,881 more than during the preceding year. In the existing state of death registration it is not easy to say whether this increase was due to greater prevalence of fever or the result of increased attention to registration.

10. *Sanitary Works.*—The Sanitary Commissioner writes:—" Beyond the improvements effected " under major works, advance in the all-important matter of improvement of water-supply has been " less than could be wished." We gather, however, from the Annual Report of the Sanitary Engineer, that works were either in progress or were completed during the year, for the supply with water of six important towns, with populations ranging from 20,000 to 90,000 inhabitants. Besides these works, a number of other schemes for water-supply or drainage were under investigation.

11. Dr. King has hopes of being able to introduce into native households a system of sewage filtration, and believes that this would effect much good where no drains exist. He has devised an apparatus made up of a kerosine tin and a funnel which he thinks might answer the purpose of a domestic sewage filter. A modification of this, he says, allows " of forced æration by a hand bellows " and by the intermittent action of a syphon." The natives of Madras must be very much more intelligent and more appreciative of the value of sanitation than the natives of India generally get credit for, otherwise any such arrangement as that proposed would, from a combination of ignorance, apathy, and neglect, probably soon bring about an increase of the nuisance it was intended to abate. An account of Dr. King's scheme will be found in paragraphs 52 and 53 of his Report.

12. A want more pressing than that of domestic sewage filters is an adequate supply of sweepers to remove night-soil. " Indeed, in some districts, the prime difficulty as to night-soil disposal is the " obtaining of this class of labour." Dr. King thinks that the difficulty can readily be overcome by local authorities importing sweepers from more favoured localities, and guaranteeing them certain privileges as to huts and lands. This may be the case; but the occurrence of similar difficulties in other provinces would suggest that sweepers of the kind required may not be so readily induced to migrate into the Madras Presidency as Dr. King anticipates. But if scavengers cannot be got, the Sanitary Commissioner describes, in paragraph 77 of his Report, a method of conservancy which, if adopted at festivals and fairs, would render their services unnecessary. He had an opportunity of

seeing this method worked on a large scale at the Tiruvannamalai festival of 1895, and says :—"It "is certainly the most expeditious, cleanly, economical, and sanitarily sound method yet used, "and is much appreciated by natives." Yet, it is no invention of modern sanitary science, but in all essential details identical with that described in verses 12 and 13 of Chapter XXIII of Deuteronomy.

13. The Report has been greatly reduced in bulk as compared with its predecessor; and if the Sanitary Engineer's Report, which is combined in the same volume with that of the Sanitary Commissioner, is in future curtailed in accordance with the instructions of Government, a still further reduction of its bulk will follow next year.

29th May 1897.

No. 11.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1895.

Judged by its vital statistics, the year was healthier than its immediate predecessor. The registered number of births exceeded the number for 1894 by 14,036, and also the mean of the 10 preceding years by 42,665, whilst the deaths were fewer than those of 1894 by 68,639. To what degree the improved health of the Presidency was due to the climatic conditions of the season is not stated. It is true that Tables A and B give the mortuary and meteorological statistics for five selected collectorates, as well as the price of food-grains in these for the year; but what is wanted, and what has been repeatedly asked by the Commission, is a paragraph briefly recording the chief meteorological features of the year, together with some estimate of the influence which the climatic conditions are considered to have exercised on the public health. Most of the annual sanitary reports from India already deal concisely with this important question. Indeed, no sanitary report of a province can well be considered complete which omits mention of the connexion between its climate and the health of its inhabitants.

2. *Vital Statistics*—Last year the Government of Bombay observed that in nine of the districts, containing half the population of the Presidency, the registration of *births* appeared to be fairly satisfactory. In the remaining districts, and especially in those of Sind, registration was shown to be defective. The same description still holds good for the year under report. In the districts in which it has hitherto been backward, it is backward still. It might be supposed that the registration of vital statistics, forming as it does the basis of all intelligent sanitary improvement, would first attain to approximate accuracy in the city of Bombay, the centre of enlightenment of the Presidency. Recent inquiries have shown that, instead of taking the lead in accuracy of registration of births, Bombay is probably more backward in this registration matter than the most out-of-the-way village in the province. From year to year the abnormally low birth-rate of the city has been recorded, and its explanation complacently accepted, as due mainly to the relative disproportion of the sexes constituting its population. The statement that there were 170 males for every 100 females was thought to sufficiently account for the birth-rate being as low as 19·07 per 1,000 of population, as compared with 35·83 for the whole province. In the Government review the true explanation of this disparity is given :—"Only last year the vaccinators discovered 5,617 infants under one year "of age whose births had not been registered." Seeing that the total number of births registered for that year was only 14,796, we have a recorded birth-rate per 1,000 of population of 18·3 instead of 25·3, and even this last may be short of the reality. This discovery has helped to explain another striking feature of the vital statistics of Bombay city. The high proportion of still-born to live-born children has annually been the subject of comment. If, as is probable, still-births are treated as deaths, and therefore like them recorded with comparative accuracy, it follows that the ratio of these should have been calculated on 20,413 and not on 14,796 live births. Registration being so defective in Bombay city, it need cause no surprise to find in a Sind district such records as a birth-rate of 19·3, or a ratio of 131·8 male children born to every 100 female children. The Sanitary Commissioner writes :—"The registration of births in Sind is apparently defective throughout the "province, and especially in the Collectorate of Hyderabad."

3. The registration of *deaths* is undoubtedly less defective than the registration of births, a result due, as remarked in the Government review, "to the necessity for burial." The ratio of deaths per 1,900 of population fell from 32·26 in 1894 to 28·61 in the year under notice, and was almost the same as the decennial mean. The ratio of 109 deaths of males to every 100 deaths of females appears to lend support to belief in the accuracy of the birth registration, according to which 108 males were born for every 100 females. But it is probable that in the record of deaths of females, as in the record of their births, omissions are more frequent than in the record of men's deaths.

4. The discrepancy between the ratios given of deaths amongst Mahommedans as compared with the ratios amongst Hindus, has attracted the attention of the Government. For the Presidency as a whole, the ratios are 20·5 of the former to 30·8 of the latter. The disproportion is most striking in Sind, and may be credited, as in the case of the other abnormal features of the record of vital

statistics throughout the country, to imperfect registration. The backward condition of registration in that division of the Presidency need excite no wonder when we find it stated that—"In many of "the larger towns and villages of the rural circles the proper census population figures are not even "recorded."

5. *Cholera* was in abeyance during the year. Only 8,890 deaths were recorded as due to it, as compared with 33,588 in 1894. It is noticeable that the year began well; there were only 37 deaths from cholera in January, and 19 in February. The severe epidemic of 1894 had almost died out; in the last month of that year there were only 92 deaths. During the year under report, cholera continued slowly to increase as the hot weather advanced, until it reached its maximum prevalence in August, in which month it caused 1,652 deaths. After this, it did not decrease rapidly as in the preceding year, but even in December was credited with 608 deaths, making it probable that 1896 would not fare so well in its first months as 1895. There was nothing in the behaviour of the disease in the places attacked by it specially deserving of record. As observed by the Government of India—"Some portions of the Report might have been condensed, and in "especial the section on Cholera, which is largely made up of quotations from the reports of the "Deputy Sanitary Commissioners." Some of these quotations are without doubt of interest, and especially the remarks by the Deputy Sanitary Commissioner, Southern Registration District, quoted at page 27; but the greater part of them might have been omitted without impairing the usefulness of the Report. The evidence given to prove importation of cholera into places attacked is of the usual description, too often inexact, and generally inconclusive.

6. *Small-pox and Vaccination.*—As from each of the other chief diseases, so from small-pox there was a diminished mortality during the year, both as compared with that for the preceding year and the mean of the previous ten-year period. Only twice during the past 12 years have there been so few deaths from this disease. As usual, a disproportionate share of the mortality fell on children under one year of age. Over a fourth of the total number of deaths occurred in this group. Amongst children of ages between 1 and 12 there were 1,255 deaths, leaving only 431 to be accounted for amongst persons of all ages above 12 years.

7. Turning to the separate Report on Vaccination, we find that 732,648 children were primarily vaccinated during the vaccination season 1895-96, and that of these 683,044, or 93·23 per cent., were successfully vaccinated. Of re-vaccinations there were 78,156, with a percentage of successful cases of 57·88. In our memorandum on the statistics of vaccination for Madras city for this same year, we expressed some surprise at the high percentage of successful cases obtained there. In primary vaccinations there were 99·66 per cent. of the cases successful, and 89·76 in re-vaccination, as compared with 93·2 in the case of the former, and 57·8 in the case of the latter in the Bombay Presidency. Of the children under one year of age calculated to have been available for vaccination, 79·88 per cent. were successfully vaccinated, leaving an unprotected residuum of over 20 per cent. Amongst this latter group the ratio of small-pox deaths is invariably high, and in proportion as vaccination reaches and reduces it, so will small-pox mortality be correspondingly diminished. Under even the most rigorous system of infant vaccination a certain number will still be left unprotected, there will always be some children whose state of health from various ailments renders them unfit for vaccination.

8. The work of the Department for the year cannot be regarded as other than satisfactory. The primary vaccinations exceeded those of the preceding year by 20,292, and the re-vaccinations by 16,986. On the other hand, their was a slight decrease in the percentage of successful cases amongst both primary vaccinations and re-vaccinations as compared with 1894. Owing partly to the difficulty of getting parents to allow vaccine lymph to be taken from the vesicles on the arms of their children, it has been found expedient to practise animal vaccination as supplementary to vaccination with human lymph. The returns show, however, that by far the greater number of operations are still performed with the latter. In our memorandum for 1894, we commented on the high cost of each successful case of vaccination in this Presidency as compared with the cost in other provinces. This, instead of diminishing, increases. In 1894 it was six annas and two pies; in the year under report it was six annas and three pies per successful case.

9. We agree with the opinion expressed in paragraph five of the Government review of the Report on Vaccination, that this might "be made shorter and perhaps more valuable by omitting from the "text mere repetitions of figures which already appear clearly in the statistical tables incorporated "in the various paragraphs, and by substituting, where necessary, such comments as would elucidate "or explain the facts implied."

10. *Fever*, although less fatal than during the preceding year, yet caused by far the greater part of the total mortality of the year. Of the 538,540 deaths from all causes, 388,848 are ascribed to fever. Although this number is less by 40,246 than the number for 1894, it is largely above the mean for the previous ten years, and was only exceeded in two of those years. The prevalence of fever is considered by the Deputy Sanitary Commissioner, Western Registration District, to have been increased, not by an unusually heavy rainfall for the year—for as a matter of fact, the rainfall was less than in 1894—but by heavy rain late in the season. His opinion, that the period at which the rainfall has possibly more to do with the general health than the actual amount of rainfall, seems reasonable:—"When late rain falls, as it did last year, the people are much more liable to "chills than when a period of comparative warmth comes between the rains and the cold season. "November and December last year showed an unusual high mortality." This opinion is shared by the Deputy Sanitary Commissioner of the Central Registration District. The influence of the price of food on fever mortality could not be determined. Regarding the Poona Collectorate we

read:—"The striking fact is the cheapness of all cereals as compared with former years; the "number of deaths from fever is, however, the largest since 1890, except last year."

11. *Sanitary Works.*—In the 168 municipalities, excluding the city of Bombay, upwards of 18 lakhs of rupees were spent on sanitary works. Of this amount, nearly half was expended in carrying out the ordinary conservancy of the towns. Close on five lakhs were spent on improving the water-supply. No large sanitary work seems to have been undertaken during the year. The extent of the sanitary work executed by District Boards may be estimated from the amount of money spent. This was a little over five lakhs of rupees. Spread over a country with upwards of fifteen millions of inhabitants, such a sum could go but a little way towards ameliorating the insanitary surroundings of so great a population.

12. Fourteen pages are given to the Report of the Sanitary Board for 1896. The Government of India consider that "too much detail regarding unimportant matters has been reproduced" from this Report. No one who has read through these fourteen pages is likely to differ from such an opinion.

13. The Annual Report of the Health Officer of the port of Bombay, which forms Appendix II of the Sanitary Commissioner's Report, is of much interest, especially at the present time. The advocates of rigorous quarantine, as the most effectual means of preventing the spread of communicable diseases, might read Dr. Crimmin's account of its results given in pages 26 and 27 of his Report. Here the following extract must suffice:—"The 'Husseinee' left Bombay on the "10th April, and arrived at Cameron on 18th idem. During the voyage she had no deaths, and "no pilgrims required medical treatment. On 24th April, *i.e.*, on the 6th day of quarantine, and "on the 14th day from departure from Bombay, cholera broke out amongst her pilgrims in camp, "and lasted with fresh imposition of quarantine until 26th May. Finally, on 31st May, as it was "clear that the 15 days' quarantine imposed after each case would, if reckoned from the 25th, "prevent the pilgrims from reaching Jeddah in time for the Haj, the vessel re-embarked the "passengers and returned to Bombay without the pilgrims having been able to perform their Haj. "They had been for 43 days in quarantine at Camaran, and 22 of them had perished—15 from "cholera and seven from ordinary diseases—all victims to an insanitary quarantine station." It is added that the "Husseinee" is one of the best of the pilgrim liners, and that her sanitary condition prior to the embarkation of the passengers at Bombay was excellent.

14. The health of the port of Bombay is said to have markedly improved during the year:—"The "retarding elements in the sanitary improvement of the port and foreshore are private owners and "the Municipal Corporation."

29th May 1897.

No. 12.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Hyderabad Assigned Districts for 1895.

Only twice during the last 28 years has the death-rate of 1895 been exceeded. The year was unhealthy beyond the average; yet there was nothing exceptional either in the meteorological conditions which prevailed, or in the price of the food supplies, which would satisfactorily account for this. The rainfall was abnormally light, and the mean temperature during the hot weather was abnormally high. The former of these conditions has generally been adduced to account for the healthiness of a season, or at all events its opposite, excessive rainfall, to account for its unhealthiness. Undoubtedly, abnormally high temperature is acknowledged to be injurious to health; but an examination of the table given on page 11 of Dr. Little's Report does not reveal any very striking difference between the temperature of 1895 and the mean of the previous five years at the three stations where observations were taken. As regards food, it is stated that *jowari*, the staple food grain of the province, was cheaper than the average of the previous five years.

2. *Vital Statistics.*—Taken as a whole, the registration of births and deaths is probably as accurately carried out in Berar as in other Indian provinces, if we take as the ground of this conclusion the approximation of the ratios to the standard fixed by actuaries for India. The inspection of birth and death registers is earnestly insisted on by the Commissioner, the Resident, and the Government of India; and without any doubt, if such inspection is thorough, it will exercise an effectual check on neglect, or worse, in the keeping of these registers. But to ensure thoroughness, more time is needful than those who have not themselves had experience of such work might suppose. Nothing short of a comparison of the registers with the result of a house-to-house inquiry can be regarded as an efficient inspection; and to carry this out, patience, time, and labour are required; more time than hard-worked district officers can often have at their disposal. It is only needful to glance at the results obtained by inspecting officers in Table No. 1, page 2 of the Report, to be convinced that there must have been differences in the strictness of the tests applied by them. Assistant and Extra Assistant Commissioners, and Civil Surgeons, found respectively only 1·5 and 1·2 per cent. of the registers defective; whilst Deputy Commissioners found 13·5, and District Superintendents of Police 9·6 per cent. defective. So wide a divergence in results can hardly be

attributed entirely to difference in the accuracy of the registers, and is likely to have been due, in part at least, to the mode in which the inspection was carried out. It is disappointing to find that so few registers were inspected by Civil Surgeons; and, looking at the small percentage of defects discovered at these inspections, there seems room to doubt if the examinations, few although they were, could have been of a very thorough description. Regret is expressed by the reviewing officers that there should have been a considerable falling-off in the number of registers examined in 1895, compared with the number examined during the preceding year. It is important that as many as possible of these registers should be annually inspected; but it is above all important that when inspection is made it should be thorough.

3. It would naturally be expected that the subject of the registration of births and deaths would receive more attention in municipalities than in rural circles. Such, however, does not appear to be the case. The Commissioner writes:—"The Municipal Committees have failed to show sufficient "interest in the matter of vital statistics, and no penalties were imposed for breach of the rules, "though the attention of all municipal committees was specially directed to this subject in accordance "with orders passed last year."

4. *Births.*—The birth-rate for 1895 rose to 37·2 per 1,000 of population, and exceeded that of the preceeding year by 3·9. In four of the six districts of the province the rate exceeded 40 per 1,000 of population; in the remaining two it was only 25·4 and 27·3 respectively. Although registration is the most backward in these two latter districts, Wun and Basim, Dr. Little thinks other causes have contributed to the lowness of their birth-rates. He personally examined the registers in several villages of Basim and Wun districts, and was struck by the high death and low birth rates recorded. Yet, he found in most instances the registers to be pretty accurately kept. In the Wun district complaint was made of scarcity of food in 1894 and 1895, on account of bad crops and the pressure of the Forest laws. This had led to the population of many villages being reduced. There were, thus, exceptional circumstances, in the case of the Wun district at least, to account for the low birth-rate, apart from the backward state of registration.

5. There were 105·2 births of males recorded for every 100 births of females. This may be regarded as a fair average, and tends to support the belief that the registration of births is, as a whole, fairly accurate. At the same time, an examination of the returns shows that there are startling variations in the proportion of the sexes of the children born in different circles. In one circle, the proportion of male to female births recorded is as high as 154·5 to 100, and in another as low as 82·2 to 100. Inquiry would probably show such extreme ratios to be due to defective registration.

6. *Deaths.*—The recorded number of deaths exceeded the recorded number of births by no less than 35,985, and was equal to a ratio of 49·9 per 1,000 of population. The ratio varied from 58·4 in Basim to 41·6 in the Wun district. In the former of these two districts the recorded birth-rate was only 27·3 per 1,000 of population; so that the death-rate more than doubled the birth-rate. In one rural circle of this district, with a population of nearly 40,000, the death-rate was 7·31 per 1,000. The high death-rate of the province was chiefly the consequence of excessive prevalence of fevers, cholera, and bowel complaints. The deaths recorded under the head of "Other causes" were also greatly more than those recorded in the preceding year, and than the average for the previous 10 years. From small-pox alone of the chief diseases there was no increase of mortality for the year.

7. *Chief Diseases.*—Fevers, although destroying life in a less sudden and sensational way than cholera, and having less than two pages of the report devoted to its history, as compared with eight pages and a coloured map to cholera, caused six deaths for every one caused by the latter. To this disease alone, a death-rate of 23·2 per 1,000 was due, and yet, when we look for some explanation of its excessive prevalence, we find that the commonly assigned cause, a heavy monsoon, not only did not occur during 1895, but that, on the contrary, the rainfall was exceptionally light. Dr. Little says:—"Until we know more regarding the origin of malaria, it is useless speculating as to the "causes which operate to favour the prevalence in certain localities more than others of the class of "disease ranged under the head Fevers." In Wun, the mortality from fever was higher than in any of the other five districts. In this district it was 27·7 per 1,000 of population. The condition of the inhabitants of Wun district as described by the Sanitary Commissioner is a miserable one:—"These "people are very poor, scantily clad, and live from hand to mouth. They usually work as field "labourers, and in seasons of scanty harvest almost starve, sustaining life with jungle fruits, especially "the *mowha* blossom and the seeds of grasses." Endeavours have been made to alleviate their sufferings from fever by the sale to them of cheap quinine; but the aboriginal Gond and Kulam inhabitants are too poor and too ignorant to avail themselves of the remedy. Such people living under such conditions will continue to fall easy victims to disease in spite of every effort which the most benevolent Government can make to save them.

8. *Cholera.*—The history of this disease in the year under notice is a continuation of its history from the previous year. In December 1894 the deaths from cholera numbered 158, and throughout the year under report no month nor district was free from it. The total number of deaths recorded as due to cholera was 11,919, or 4·2 per 1,000 of population. But such a record in Berar is by no means exceptional. During the 28 years for which statistics exist, this rate was reached or exceeded on the average every fourth year. Dr. Little considers cholera to be endemic in the province. Yet, in two consecutive years the return given on page 12 shows that there were no deaths in the province from it during the one, and only two during the other.

9. Extracts from the reports of Civil Surgeons are given, detailing the circumstances under which the disease made its appearance in their districts. In some cases evidence has been adduced to prove that it was imported into the places attacked. The Civil Surgeon of Buldana clearly traced the first case of cholera, which occurred on the 16th of May at the village of Belodi, to importation. On the 13th of May, a man named Mimah visited the village of Manegaon, where cholera was said to be prevalent, and returned to Belodi on the 15th. The first case of cholera occurred in Belodi the day after Mimah's return. Therefore, the disease was, in the Civil Surgeon's opinion, imported. Unfortunately for the soundness of this conclusion, it was subsequently ascertained that no case of cholera occurred in the Jalagaon circle, in which the village of Manegaon is situated, until the 21st of May, or six days after the return of the man Mimah to Belodi. The Civil Surgeon of Akola attributes the appearance of the disease, in one instance, to local causes. The Sanitary Commissioner himself, believing cholera to be endemic in Berar, would not, of course, consider importation necessary to explain an outbreak.

10. The Resident of Hyderabad in his review of the Report thinks that "whether cholera is "endemic in Berar or is imported, there is no better prophylactic against it than pure water." He further adds:—"It is not meant, of course, that conservancy or drainage should be neglected; if "they are, the good effects of a pure water supply are likely to be neutralized." In the present state of our knowledge of the disease, the measures most likely to be successful in preventing it could not be better indicated.

11. *Small-pox* was credited with only 556 deaths during the year, or a ratio of ·2 per 1,000 of population. Of the total deaths from this disease, 205, or 36·9 per cent. occurred amongst infants under one year of age, and 312, or 56·1 per cent., amongst children over one and under 12 years of age. "Thus," as the Sanitary Commissioner writes, "out of 100 deaths amongst persons of all ages, "93 were reported to have occurred under the age of 12, which demonstrates the importance of "infantile vaccination." Table No. 13, given at page 209 of the Report, is a satisfactory record of the steady diminution of small-pox mortality accompanying corresponding progress in the spread of vaccination since the introduction of the latter into Berar in 1868. An examination of Table No. 13 of the Report on Vaccination for the year, shows that the Province of Berar occupies a very favourable position as regards vaccination, when compared with other provinces. Judged by the practical test of the diminution of deaths from small-pox, the only provinces showing better results are Assam and Bombay. Dr. Little is justified in saying:—"The success secured in the reduction of the "death-rate from small-pox is one of the most gratifying results obtained by the Sanitary "Department." This success the Resident acknowledges to be due in great part to the strong personal interest Dr. Little takes in vaccination, and to the supervision he has exercised over the Department.

12. *Dysentery and Diarrhœa* accounted for 24,452 deaths, a number not reached in any year since 1878. These diseases increased and diminished in their prevalence throughout the year with the increase and diminution of fever, and were doubtless largely influenced by the same causes as the latter.

13. *Sanitary Works.*—The 11 municipalities expended during the year somewhat over a lakh of rupees on drainage, water-supply, and domestic cleansing. From this it is evident that no large scheme of sanitary improvement under the headings mentioned was undertaken. Dr. Little states that "conservancy and general measures receive considerable attention, but a little more individual "attention by members of Committee in their respective wards is desirable." When it is seen that the estimated annual income of the whole of the municipalities amounts to a total of less than two and a half lakhs of rupees, it cannot be expected that sanitary improvement in Berar should be very rapid. At the same time, the Report shows that the limited funds at their disposal are being turned to good account by the authorities.

14. In the year 1888 a systematic sanitary survey of the towns and villages of Berar was commenced, and up to 1895 the total number of surveys completed of the former was 33, and of the latter 626, leaving 6 towns and 5,160 villages still to be surveyed. At the rate it has been proceeding since 1888, the survey of villages will not be completed for nearly 60 years. Writing of urban and rural sanitation in the Buldana district, Dr. Little says:—"There is not much progress to be reported "in this direction. The people for the most part neither care for nor want sanitation, and until "legislation is brought to bear, I fear we cannot do much to effect reform." Perhaps *education* in this sentence might be substituted for *legislation.*

29th May 1897.

No. 13.

Memorandum by the Army Sanitary Commission on the Administrative Report of the Commissioners of the Town of Calcutta for 1895–96.

As usual, the Report deals with the health of Calcutta for the calendar year only. In our memorandum for 1894 we stated that the health of the town for that year was not good. During the year under notice it has been greatly worse. The birth-rate, which in 1894 had fallen to 16·8 per

1,000 of population, still further fell in 1895 to 16·0; whilst the death-rate, which had in the former year risen to 32·9, rose to 39·6. This, as the Health Officer remarks, "is a very unsatisfactory condition of matters."

2. It does not appear that there was in the meteorological character of the season any deviation from normal sufficient to account for this great increase in the death-rate. Neither could the increase be accounted for by the dearness of food. On page 135 a table is given which shows the comparative price of "common" rice for each of the last 11 years. From this it is seen that rice was cheaper in 1895 than during either of the preceding three years. Although both cholera and small-pox were more fatal during 1895 than during the previous year, the chief increase in the death-rate was due to fever. From this last the number of deaths rose from 8,963 in 1894 to 11,345 in the year under notice, and constituted 41·9 per cent. of the total mortality of Calcutta. This increased mortality from fever was not confined to any one part of the town and suburbs, although it was specially marked in the canal area, which is low-lying, water-logged and sewer-logged to a greater extent than any other part of the town. "The high rate of mortality from fever in the "suburbs," writes Dr. Simpson, "is due to its undrained condition aggravated by the introduction "of a public water-supply, without adequate provision for the removal of the waste water." With regards to the town, he adds, "There is provision for the removal of waste water, but the defects in "the drainage system in relation to the outfall place it in the rainy season in much the same position "as the suburbs, and the system possesses its own peculiarities in construction that render it a "manufactory of fever under favourable climatic conditions." No one will question that the local conditions described must be potent factors in the production of fever; but they are permanent causes, and although their influence may show no tendency to diminish from year to year, they seem inadequate to account for the sudden increase in the mortality from fever during 1895. If, however, we look beyond Calcutta, we find that this increase in the death-rate from fever, aggravated although it doubtless must have been in the case of Calcutta itself by the local insanitary conditions described by the Health Officer, was due to general influences which affected the surrounding country as well as the town. Turning to page 31 of the Report of the Sanitary Commissioner of Bengal for 1895, we find that in the districts of 24-Parganas, Howrah and Hooghly the death-rate from fever rose, in the first from 17·25 to 21·05, in the second from 13·09 to 16·20; and in the last from 25·46 to 28·48. In Calcutta it simultaneously rose from 13·15 to 16·64. In other words, Calcutta shared in nearly the same proportion as the surrounding country this increase of fever mortality during the year 1895. The importance of separating the local from general causes of sickness we took occasion to notice in our memorandum on the Administration Report of the Commissioners of Bombay for the same year.

3. Cholera, as well as fever, was greatly more prevalent than during the preceding year. The number of deaths from this disease rose from 869 in 1893 and 1,695 in 1894 to 2,090 in the year under report. The Health Officer says:—"The part which the tanks of Calcutta play in cholera "prevalence is well known." But seeing that these are becoming annually fewer in number, the increase in cholera prevalence can hardly be credited to the tanks. Another factor concerned in the causation of cholera is stated to have been the occurrence of cholera microbes in the river at and near the bathing ghâts, and the supply of this water to the bathing platforms in the towns. We are not told precisely how this acted in the production of cholera, or if the microbes were discovered more frequently or in greater abundance during the past than in previous years. In addition, the passage of pilgrims through Calcutta is considered to be concerned in the causation of cholera. "The pilgrims are only for a short time in the town, but they remain sufficiently long to leave "behind them many new centres of cholera infection." No return appears to be given showing the number of pilgrims who suffered from cholera whilst passing through Calcutta; so that we have no data from which to estimate the part which these played in the causation of cholera in 1895. It may be presumed, however, that their visit to the town is of annual occurrence, and that cholera prevalence in other years, no less than in 1895, was influenced by their passage.

As a prophylactic against cholera, 2,038 persons were inoculated by Professor Haffkine's method during the year. Dr. Simpson says:—"Precise observations have proved that this method reduces "the mortality in the first four days by an average of 3·24 times, and that the people inoculated "after this period acquire a protection which, for a year at least, renders them 22·62 times safer "than the uninoculated." Yet the people of Calcutta do not appear to be quite satisfied with the degree of protection thus conferred, otherwise more than 2,038 would surely have had themselves protected against a deadly disease which was never absent from their midst throughout the year.

It is satisfactory to find on record that "the filtered water has maintained its general character as "a pure and wholesome water throughout the year." Those who insist that cholera is "solely a water-borne" disease will find it somewhat difficult to get their theory to fit in easily with the facts stated, or with the figures recorded on page 169 of the Report. According to these latter, of 2,147 cases found on inquiry to be genuine cases of cholera, 457 were traced to importation from places outside Calcutta, 122 to communication with previous cases, and 337 were associated with unwholesome food, 125 with defective water supply, 32 with milk brought from outside town and suspected to be diluted with polluted water, and 275 with overcrowding and other insanitary conditions. The connection traced between the disease and the conditions associated with its appearance is thus seen to be of anything but a constant nature, and avowedly to rest in some cases on suspicion rather than on ascertained facts.

4. To the increased mortality of the year small-pox largely contributed. The number of deaths from this disease rose from 31 in 1893 to 405 in 1894; and to no fewer than 2,220 in the year

under report. Of this last number, it is disappointing to find that 501, or nearly one-fourth, occurred amongst those who had previously been vaccinated. But of these vaccinated cases the greater number of deaths took place amongst persons of ages between 10 and 40 years, "plainly showing," as Dr. Simpson observes, "the necessity of re-vaccination." As usual, the brunt of the epidemic fell on children under five years of age who had not been protected by vaccination, inoculation, or a previous attack of small-pox. Amongst this group 708 deaths occurred, or nearly a third of the total number. The contrast between the fate of these unprotected children and those who had undergone vaccination places the prophylactic value of vaccination in the strongest light. There was not a single death amongst vaccinated children under five years of age. Even amongst vaccinated persons of ages up to 20 years, although there were 34 attacks, no death resulted. Equally strong is the proof in favour of the protection conferred by re-vaccination. During this severe epidemic not a single case of small-pox occurred amongst persons "who had been or were re-vaccinated."

The Health Officer describes some of the difficulties which are met with in dealing with an outbreak of small-pox in Calcutta. The chief of these are the concealment of those attacked by the disease, through dread of their being removed to hospital, and to its being difficult or impracticable to secure the isolation of small-pox patients. "The law gives no power to the sanitary authorities to isolate "females and infants by removal to hospital;" and infants under five years of age were the greatest sufferers from small-pox.

5. Turning to the returns of vaccination, the first point that strikes us is the obvious neglect of infant vaccination. The number of children born was 10,945. Deducting from these, 4,663 who died under one year of age, 6,282 remained available for vaccination. But the number of children under one year of age vaccinated was only 5,253, leaving 1,029 unprotected. No doubt the total number of persons who underwent primary vaccination, 15,184, is largely in excess of the number of children born; but, nevertheless, a severe epidemic of small pox occurred. This shows that in protecting a community against small-pox it is of the first importance to secure thorough infant vaccination. During the prevalence of the epidemic there were no fewer than 39,789 re-vaccinations performed. Of this large number only 4,080 proved successful. The ratio of ascertained successful cases of re-vaccination was thus 13·32. In Madras city the percentage of success in re-vaccinations is recorded as having been 89·76. It may be that, there, any appearance of local irritation following the operation was taken as indicating success. Besides the difficulties already described as having been met with in the endeavour to extinguish this severe epidemic of small-pox, scarcity of vaccine lymph is also mentioned. "During the hot months, such as May and June, calf lymph deteriorated, and all "vaccinations proved unsuccessful." But were infant vaccination thoroughly enforced, outbreaks of small-pox on the scale of that of 1896 would probably rarely occur, and the difficulties complained of would not have to be faced.

6. As in the case of the diseases already briefly dealt with, diarrhœa and dysentery were more prevalent than during the preceding year. To these, 3,269 deaths were attributed, as compared with 3,136 in 1894, and with a mean of 2,769 for the six years 1889–94. In short, the year was an unhealthy one, and the high rate of mortality due, not to the epidemic prevalence of one disease, but the result of a general increase in the severity of nearly all diseases.

7. *Sanitary Works.*—Sanitary authorities maintain that there is no better index of the sanitary state of a town than the record of its infant mortality. Measured by this scale, Calcutta is one of the most backward cities, as regards its sanitary condition, in the world. Of the children born, 476·0, or nearly half, died before reaching one year of age. Little wonder if Dr. Simpson writes:—
"The high mortality amongst infants is a prominent and discreditable feature of Calcutta, and "urgently calls for improved sanitation in connection with the construction and cleanliness of "dwellings, and the proper regulation of the milk supply, in addition to the general drainage and "cleanliness of the town."

For five years the general drainage question has been discussed, and at length a definite conclusion regarding it would seem to have been arrived at. If the efficiency of the scheme proposed should prove to be commensurate with its cost, it ought to be a great success. It is estimated to cost about 79 lakhs of rupees, and this is less than half the estimate for the alternative scheme submitted to the Commissioners. Although the efficient drainage of Calcutta is one of its most urgent sanitary needs, scarcely, if at all, less important is the pressing necessity of proper building laws. "It is impossible," writes the Health Officer, "for a city to grow up in a healthy state in a haphazard manner, such as is "permitted in Calcutta, where areas have sprung up, and are springing up, all over the town in "defiance of every canon of sanitary law." As the Lieutenant-Governor remarks in his review of the Health Officer's Report, these observations deserve, more especially at the present time, the most serious consideration on the part of the Commissioners. It is well known that the plague, now knocking at the doors of many Indian towns, finds its most congenial habitat in crowded and insanitary dwellings, such as those which, for years, have been allowed to grow up in Calcutta in spite of the earnest warnings and remonstrances of the Health Officer.

29th May 1897.

No. 14.

Memorandum by the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1895–96.

This Report has the merit of brevity. The main facts relating to the public health of the City of Madras are set forth clearly and concisely. The year, judged from the statistics of mortality, was not quite so healthy as its predecessor. But it is explained by the writer of the Report that the higher death-rate was in part due to the increase in the birth-rate. The prevailing meteorological conditions do not show any striking deviation from normal. An opinion is expressed that the increase in the number of bowel complaints in August, September, and October may partly be attributed to the damp and cloudy weather experienced during those months. But it is generally believed that high temperature during the autumn months in India, as in England, favours the prevalence of those complaints; and it is stated that the mean temperature of the air was below normal in August and October. There was no appreciable change in the price of food as compared with that of the previous year, except in the case of *Ragi*, which was much cheaper.

Vital Statistics.—The *births* exceeded in number those of 1894 by 2,075. This increase took place in the second half of the year, and is said to have been due to food having become appreciably cheaper during the year 1894, and to its remaining so during the year under report. The birth-rate per 1,000 of population was 42·2, and was the highest recorded during the past 10 years. The number of still-births was 513 as compared with 541 in the preceding year. These figures contrast strikingly with the corresponding figures for the City of Bombay. In this latter the birth-rate was less than half that recorded in Madras, or 19·08 as compared with 42·2; whilst of a total number of 17,154 children born in Bombay, 1,470 were still-born, as compared with 513, out of a total in Madras of 19,650. It would be of interest to have an explanation of this remarkable difference between the two cities, with regard to the number of still-born children.

The *deaths* registered during the year numbered 17,052, against 16,542 in 1894, and were in the proportion of 37·6 per 1,000 of population, the mean for the decade being 38·7. Registration of births and deaths would appear to be carried out with much thoroughness; only one birth and two deaths remain unregistered. Even as regards these three cases, a satisfactory explanation is given in each of the reason which led to its having escaped registration.

Chief Diseases.—As usual, fevers caused a greater number of deaths than any other single disease. Under this head 6,265 deaths are entered, or equal to 13·8 per 1,000 of the population. This is slightly in excess of the mortality from fevers in 1894, and considerably in excess of the average for the previous 10 years. The permanent causes of the prevalence of fever are well known, and until they are removed it is hopeless to look for a diminution of this prevalence. The chief of these causes are defective drainage, and an impure water supply. Both exist in Madras, and as yet no substantial progress has been made towards their removal. Of the temporary causes, the President assigns importance to the price of food; the prevalence of fever has been found to increase and diminish with the rise and fall of the price of food.

Bowel complaints were considerably less fatal than during 1894, and greatly less fatal than they were on the average during the previous 10 years.

Small-pox and Vaccination.—The disease and its antidote, may be taken together. The former is credited with only three deaths, the smallest number recorded from this disease in any year except 1886, when only one death occurred. No better proof could be given of the efficiency with which vaccination is carried out. It is worthy of note, also, that all three deaths were of persons over 20 years of age, showing that infant vaccination, neglect of which is so generally the main cause of small-pox mortality, receives careful attention in Madras. This immunity of young children from small-pox is sufficiently accounted for by the vaccination returns. From these latter it is seen that, of 19,137 children born, 519 were still-born and 5,408 died under one year of age. This leaves available for vaccination 13,496. Referring to the table given in Appendix IV, it is found that 13,027 of these were successfully vaccinated. Of the remainder, 33 were unsuccessfully vaccinated, whilst the result was not ascertained in 127 cases. Only 309 remain to be accounted for; and many of these, out of so large a total as 13,496 children, would doubtless be found unfit to undergo vaccination, owing to infantile ailments of various kinds.

The total number of vaccinations performed during the year was 27,024. Of these, however, only 18,877 were primary vaccinations. The remainder, 8,147, were cases of re-vaccination. In both primary and re-vaccination operations, the recorded percentage of successful cases is somewhat surprising. Of the former, 99·66 per cent. are returned as having been successful, and of the latter, 89·76. If almost cent. per cent. of the primary operations were genuinely successful, we cannot accept without hesitation a return which gives so high a percentage of re-vaccinations. In our memorandum of last year we commented on the high percentage of successful cases of re-vaccination recorded in Madras, and pointed out that in other provinces of India, such as Bombay and the North-Western provinces, nothing approaching to these results had been attained. It should not be forgotten that, if the quality of primary vaccination is high, the percentage of successful re-vaccinations following thereupon will be proportionately low. Or, put in another way, a high percentage of successful re-vaccination does not indicate a high quality of the primary vaccination which preceded it. But the practical test of the efficiency of vaccination is, after all, the immunity from small-pox which it confers, and, judged by this test, vaccination as performed in Madras city is efficient.

Cholera caused 122 deaths, as compared with 77 during the previous year. Yet the number was far below the average of the preceding 10 years, which was 481·8. One hardly expects to read that part of the increase in the number of deaths over the number in the last quarter of 1894 "was owing to the outbreak of cholera in the Government Lunatic Asylum." One would naturally expect to find an institution under the direct management of a medical officer, and presumably fortified by scientific sanitary precautions against the ingress of epidemic disease, to be less likely to be attacked by cholera than insanitary city slums; and yet, as in the case of the Jamsetjee Hospital in Bombay in 1894, so in the Madras Lunatic Asylum in 1895, cholera passes over the crowded slums and elects as its field of operation institutions arranged and managed in conformity with modern sanitary principles.

Sanitary Defects.—Practically, no progress has been made during the year in providing the city with an efficient drainage system. The expenditure of the year under the head of drainage amounted to Rs. 52,333. Seeing that the scheme which the Commissioners favour is estimated to cost about 28 lakhs, it is evident that this still remains in abeyance. Yet, the President writes:—"No great "reduction in the mortality of the town can be expected until a good system of drainage and sewerage "has been carried out." It is encouraging, however, to learn that Government have made a grant of three-and-a-half lakhs of rupees towards the drainage of Madras, "and it is hoped that some progress may be made during the next year."

Although the water supply has been considerably improved as regards its quantity, no steps have yet been taken to improve its quality. "The analysis of water," writes the President, "is anything but satisfactory." Considering that the supply is unfiltered, this is not much to be wondered at; but, as stated last year, the cost of any efficient scheme hitherto proposed for filtering the water supply of Madras would be beyond the means of the Municipality.

The difficulty in obtaining a sufficiency of conservancy coolies to carry on the every day details of cleansing the city has become serious. "It has been found absolutely impossible to obtain the full complement of scavengers for the conservancy work in Madras." One of the reasons given for the decrease in the quantity of rubbish carted away as compared with that carted during the previous year is "inability to obtain the full complement of men."

Many useful improvements have been, and are being, carried out in the interest of the public health. Of these, some of the most important are, the steps being taken to put an end to the practice of intramural burial, the closing of private slaughter-houses in inhabited and crowded localities, the opening out, by driving wide streets through them, of crowded, ill-ventilated parts of the town, the cleansing and regulation of bakeries, and the ventilation, drainage, and paving of cattle yards. None too soon, "a house-to-house inspection is being conducted in all the divisions with a view to mitigate "insanitary conditions. The plans submitted for the erection of buildings are thoroughly scrutinized "and no plan is passed which does not conform to the rules of sanitation as to drainage, ventilation, "latrine accommodation, &c." Altogether, it is clear that there is no lack of energy in the management of the Health Department of Madras. The want is the want of the funds needful to carry out the drainage and water improvement schemes which everybody knows to be necessary before any decided impression can be made on the persistent high mortality of the city.

29th May 1897.

No. 15.

Memorandum by the Army Sanitary Commission on the Administration Report of the Municipal Commissioner of Bombay for 1895–96.

1. The year 1895 was more favourable to the public health than its predecessor. The number of deaths decreased from a total of 27,330 in 1894 to 25,081, or from a ratio per 1,000 of population of 33·25 to a ratio of 30·52. The chief decrease is shown under the headings of Diseases of the Respiratory System, of the Digestive System, Cholera, and Small-pox. Under the head of Fevers the decrease was only slight.

2. The Health Officer attaches to his report a chart which shows very clearly that, when Bombay suffers from epidemic influences, these influences are not confined to the city, but simultaneously affect the country around. The separation of these general causes of sickness from local causes is important. Whilst the former are, in the present state of our knowledge, imperfectly understood, and mostly beyond human control, the latter can be measured by their effects and definite measures taken for their removal. The improvement in the health of Bombay during the year under notice was due, the Health Officer considers, to the absence of the former general causes of sickness, and not to any marked amelioration in local sanitary conditions. With prophetic foresight Dr. Weir writes:—"I cannot hope for further reduction in the mortality until the local insanitary causes that "I have so frequently described, and which I will once more describe so that there may be no "responsibility on me, are removed."

3. *Vital Statistics.*—The *births* of 15,684 living children were registered. These give a birth-rate of 19·08 per 1,000 of population. So low a ratio is accounted for by the disproportion of the sexes, there being in Bombay only 100 females to every 176 males. The Health Officer concludes from an examination of the registers of births according to class of the population that the birth-rate

is not far from correct. The chief increase in the rate has taken place amongst low-caste Hindus. The birth-rate amongst this rapidly increasing class was as high as 34·93 per 1,000 of population. As might be expected, the proportion of women to men in this class is higher than the proportion for the population of Bombay as a whole. Amongst the low-caste Hindus there are 100 females to every 134·96 males.

As already stated, the number of *deaths* gives a ratio of 30·52 per 1,000 of population. In the absence of any severe outbreak of epidemic disease the rate is a high one, and due without question to the operation of the insanitary conditions so repeatedly described by Dr. Weir. From cholera, only 90 deaths were registered, and from small-pox 270. On page 592 of the Report, a table gives the death-rate in each section of the city. This varies from 50·61 in 2nd Nagpadia to only 3·02 in the Water Division. The overcrowding in the former section is excessive, there being on the average 15 families, or 67·18 persons in each house.

4. *Chief Diseases.*—Of the total number of deaths, 6,404 were caused by *fevers*, as compared with 6,458 in the preceding year. The persistently high death-rate from fevers in Bombay is due to well-known conditions. "There has been an enormous increase in the water supply since 1892, "from 16½ million gallons to some 29 millions or more daily, and very little increase in the number "of drains. The island is flooded or irrigated with water, and unless drains are constructed to take "away all the water that comes into the city, the life of a healthy population will not be possible; "what has been seen in countries of marsh and wet, the poisoning of life from malarial fevers, will "be seen here."

Diseases of the Respiratory System, next to fevers, caused the greatest number of deaths, no fewer than 4,565 having been registered under this head. As might be expected, the mortality from these diseases is highest where overcrowding is greatest. In 2nd Nagpadia the ratio of deaths from diseases of the respiratory system was 10·28 per 1,000 of population, and in this section of the city overcrowding reaches its maximum.

Phthisis is credited with having caused 3,610 deaths. It owes its prevalence to much the same conditions as diseases of the respiratory system. This is well shown in the table on page 589 of the Report. Where these diseases were most fatal, as in 2nd Nagpadia, there, too, was phthisis most fatal.

Diarrhœa and Dysentery were considerably less fatal than during the preceding year. Between them they accounted for only 1,813 deaths, as compared with 2,344 in 1894, or rather more than the average of previous years.

Small-pox caused 270 deaths, against 531 in 1894. As usual, children under four years of age suffered most. And yet, when the returns of vaccination are examined, it is seen that, whilst the number of living children born during the year was 15,684, the number of those under one year of age who were successfully vaccinated was 14,470. If, from the number of children born, 6,683 who died before reaching one year of age be deducted, it will be evident that the remainder, 9,001, is greatly less than the total number successfully vaccinated under one year of age. The statistics of births and of vaccination go, therefore, to show that the mortality from small-pox amongst children under four years of age was not chargeable to neglect of infant vaccination.

The mortality from *cholera* was unusually small. Only 90 deaths were registered as due to this cause. It is worth noting that in the section of the town, 2nd Nagpadia, in which the death-rate from all causes was highest, there was but one death from cholera; whilst in the Water Division, in which the mortality from all causes was by far the lowest, there were seven deaths from this disease. In other words, the death-rate from cholera in the healthiest part of the town was ·31 per 1,000 of population, and in the unhealthiest, as estimated by the mortality, only ·05. Dr. Weir gives other interesting statistics regarding the incidence of this disease. He finds, for example, that 40 per cent. of the deaths occurred amongst persons living on ground floors. Last year, as many as 81·6 per cent. of all the cases occurred on ground floors. He likewise finds the same results as in former years, when the ages of those attacked are compared—a small number of cases with a light mortality at an early period of life, and an increasing mortality as years advance. The purity or impurity of the water supply, as estimated by analysis, does not seem to stand in any definite relation to the prevalence of cholera during the year. Both the Tulsi and Vehar supplies were most impure in April; during that month there were two deaths from cholera. "In July the Tansa "water was almost pure"; in the same month there were three deaths from cholera. So, likewise, when in December the Tulsi water from the Malabar hill was of more than the average good quality, the number of cholera deaths during that month was 10.

5. *Sanitary work.*—Although from year to year the Health Officer has felt himself compelled to set forth in the strongest terms the sanitary defects of Bombay, it must not be supposed that the executive authorities are not using their utmost efforts, with the means at their command, to remove these defects. They have already at vast expense provided their city with an abundant and pure water supply. Indeed, one of the complaints of the Health Officer is that, in the absence of a sufficient drainage system, the supply is too abundant. It must be not a little disappointing to the municipality to find that after this excellent supply has been provided, the annual revenue from water falls short of the expenditure by nearly two lakhs of rupees.

Drainage works, the most urgent sanitary need of the town, are vigorously pushed forward. On the Colaba sewerage works, over seven and a half lakhs had been expended at the close of the year. On five other important drainage works, sums of money, varying from 35,000 to upwards of two lakhs of rupees were expended. Two more drainage schemes were sanctioned and money provided for their execution, although they had not been commenced at the end of the year. And yet, "in more

" than half the island there are not drains." This shows that though much has been done and is being done, the condition of Bombay as regards drainage fully justifies the description given of it by Dr. Weir.

6. Recent events have shown that other sanitary improvements of a no less urgent nature than drainage are required in Bombay. The insanitary and overcrowded state of the houses in some sections of the town are a source of the greatest danger to the public health. This has not escaped the vigilance of the Health Officer. "It is deplorable," he writes, "that houses in the most crowded "portions of the city can be rebuilt without leaving on one side an open space for ventilation and "drainage. It seems of little avail having Building Byelaws when people can build where houses "are closest together, without leaving on one side a gully for open air, for light and for drainage. "Public attention is affected by the loss of life, however small, when a building falls, but here we "have, through imperfection in the Municipal Law, many people annually poisoned by foul air." In our Memorandum for 1894 on the Administration Report of the Commissioners of the town of Calcutta we invited attention to the site crowding with lofty, ill-ventilated houses which is permitted in that city. The remonstrances of Health Officers may for a time fail in their purpose; but sooner or later they will be driven home by events which will admit neither of question nor delay.

29th May 1897.

REPORT

ON

SANITARY MEASURES IN INDIA

IN

1896-97.

VOL. XXX.

Presented to both Houses of Parliament by Command of Her Majesty.

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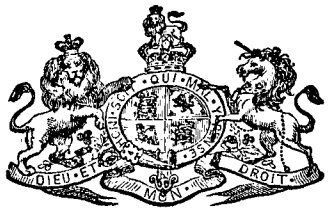

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A. GODLEY,
Under Secretary of State for India.

INDIA OFFICE,
13*th December* 1898.

REPORT.

The present Report on Sanitary Measures in India during the year 1896 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1896.

The health of the European troops on service in India during 1896 was on the whole satisfactory. On an average strength of 70,484, the admissions into hospital were in the ratio of 1,387 per 1,000, against 1,462 in 1895, the daily sick-rate was again 94, and the death-rate fell from 15·26 to 14·84. The invaliding ratio (28) was higher by 5 per 1,000, so that the total loss by death and invaliding was equal to 43 per 1,000, an increase of 4 per 1,000 on the previous year.

The Presidential Army system was abolished in 1894, and the whole of the forces in India is now designated the Army of India, divided into the Bengal, Punjab, Madras, and Bombay Commands. This organization took effect from the 1st April 1895.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands during 1896 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1896	22,457	1,436	100	18·70	29	48
	1895	22,259	1,436	98	16·98	26	43
Punjab	1896	18,823	1,282	84	13·60	26	40
	1895	19,733	1,519	92	20·02	18	38
Madras	1896	13,488	1,336	99	9·79	33	43
	1895	13,417	1,227	91	8·79	31	40
Bombay ...	1896	15,716	1,485	92	15·14	24	39
	1895	15,622	1,627	92	12·35	21	33
INDIA ...	1896	70,484	1,387	94	14·84	28	43
	1895	71,031	1,462	94	15·26	23	39

It will be seen from the above statement that of the four Commands Bengal had the highest daily sick and death rates. The Madras Command was the healthiest, and its death-rate was not much more than half that of Bengal.

The chief causes of sickness in the whole European Army were, as in the year 1895, venereal diseases and ague, the former yielding a ratio of 512 per 1,000 against 522 in 1895, and the latter 239 per 1,000 against 336. More than half (54 per cent.) of the total sickness resulted from these two causes. Enteric fever, as usual, was the chief cause of mortality, and the death-rate from it was 6·31 per 1,000 against 6·72 in 1895. This fever yielded 43 per cent. of the total deaths.

Groups of stations.

The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,310	1,469	116	11·45
Burma, Inland	2,679	1,593	111	5·60
Bengal and Orissa	2,460	1,302	80	17·07
Gangetic Plain and Chutia-Nagpur	7,492	1,394	101	22·42
Upper Sub-Himalayan	14,390	1,341	92	13·83
Indus Valley and North-Western Rajputana...	4,837	1,669	95	14·47
South-Eastern Rajputana, Central India, and Gujarat.	6,440	1,756	120	19·72
Deccan	10,157	1,317	90	14·67
Western Coast	1,556	1,110	78	17·99
Southern India	3,561	1,209	78	11·23
Hill Stations	8,776	1,209	90	12·53
Hill Convalescent Depôts	3,591	1,197	88	12·53

Of the above 12 groups, five returned a higher daily sick-rate than the ratio for the whole European Army, the highest being 120 per 1,000 of average strength in South-Eastern Rajputana, Central India and Gujarat group. The two Burma groups followed with ratios of over 110, and the Gangetic Plain and Chutia-Nagpur next with 101. The lowest ratios (78) were returned by the Western Coast and Southern India groups. The death-rate of the entire Army was exceeded by four groups, viz., the Gangetic Plain and Chutia-Nagpur, South-Eastern Rajputana, &c., Western Coast and Bengal and Orissa groups.

Of the stations with a strength of over 1,000, four returned death-rates above 20 per 1,000, viz., Allahabad 37·61, Fyzabad 23·93, Lucknow 20·42, and Agra 20·37.

Cholera. The mortality from cholera in the European Army was higher than in 1895. The admissions to hospital from the disease numbered 70 or 1·0 per 1,000 of average strength, against 44 or 0·6 per 1,000 in 1895, and the deaths rose from 32 or 0·45 per 1,000 to 63 or 0·89.

Small-pox. Among the whole of the European troops in India there were during the year under notice 122 cases of small-pox ; of these ten were fatal. In the previous year there were only 19 cases and two deaths.

Fevers. From intermittent fever the admissions to hospital among the European troops in 1896 were in the ratio of 239 per 1,000 of strength against 336 in the previous year. The deaths under this head numbered 7, a decrease of 11 on the mortality of 1895. Of these, 5 occurred among troops in the Bengal Command and 2 among those in the Bombay Command.

From enteric fever the admissions fell from 1,870 or 26·3 per 1,000 of strength to 1,795 or 25·5, and the deaths from 477 or 6·72 per 1,000 to 446 or 6·31. Of the four Commands Bengal recorded the highest mortality under this head, viz., 7·70, followed by Bombay with a ratio of 6·36, Punjab 6·11, and Madras 4·23. Among the larger stations with an average strength of over 1,000, Allahabad returned a death-rate from this fever of 27·20, Fyzabad 12·96. Agra 12·40, Peshawar 10·72, Ranikhet 10·58, and in six other stations the ratios ranged from 9·50 to 6·92. As usual, young and unacclimatised soldiers were the chief sufferers ; among those under 25 years of age the death-rate was 9·52 per 1,000 against 8·22 in 1894, while among men between 25 and 29, and from 30 to 34, the mortality was 3·24 and 2·18 per 1,000 respectively. Among men of less than one year's residence in India the death-rate from this fever was 14·40 per 1,000, among men between one and two years 8·59, and among troops between five and ten years' service the rate was 2·44 per 1,000.

Bowel complaints. The admissions from dysentery and diarrhœa among the European troops were in the ratio of 46 per 1,000 of strength, or 13 per 1,000 less than in 1895. The mortality from dysentery was in the ratio of 0·67, and from diarrhœa 0·01 per 1,000. Dysentery was most prevalent in the Madras Command.

Venereal diseases, as usual, came first in the list of causes of admission to hospital ; and also in the causes of invaliding. They were the cause of 37 per cent. of the total sickness during 1896, and over 24 per cent. of the invaliding of the European Army of India. The ratio of admissions from venereal diseases per 1,000 of strength was 512 or 10 below that of 1895. This is vastly in excess of the ratio of most continental armies, and also of the ratios of British troops in most other parts of the world. The admission-rate under this head was highest in the Bengal Command, viz., 582 per 1,000, next came Bombay with a ratio of 537, Madras with 526, and the Punjab with 395, but only in Bombay was there an increase. The number of men constantly sick in hospital from these diseases was 3,162, against 3,165 in the previous year, being equivalent to over three regiments ; and the average stay of a case in hospital in each year was about 32 days. The mortality under this head was 14, and the invalidings 479, against 15 and 353 respectively in 1895. Dr. Cleghorn, Sanitary Commissioner with the Government of India, in his report for the year under notice, again furnishes figures "showing clearly " how the arrival year by year of fresh batches of young unmarried men under the short " service system has been accompanied by an increase of venereal disease. Since 1878 " the number of fresh troops arriving in the country has, as a rule, been much greater " than before. The gradual rise in the percentage of men under 25 years of age in " the army, and of men under five years' Indian service has been pretty uniform, as " has been the well-marked decline in the number of married men ; and the same " may be said of the gradual rise in the venereal ratio. As youth and recent arrivals " have become more common in the army, venereal disease and enteric fever have not " unnaturally increased in frequency of occurrence." Statistics also show "a more or " less continuous rise, especially since the year 1884 ; and the ratio of secondary syphilis " is the highest on record. This is a condition of things which is sure to tell when the men " have to go on field service." Venereal diseases.

The loss to the whole army by invaliding during 1896 amounted to 1,966 men, equal to 27·89 per 1,000, against 1,663 or 24·82 in 1895. The proportion of invalids to strength was highest in the Madras Command (33·2), followed by Bengal (29·2), Punjab (25·7), and Bombay (24·1). Of the total number invalided, 39 per cent. were discharged as unfit for further service, being 6 per 1,000 higher than in 1895. As regards the influence of age and length of residence in India upon invaliding, 62 per cent. of the total number invalided were under 25 years of age, against 60 in 1895, while 40 per cent. were of less than two years' service, and 85 per cent. were of less than five years' service. In the European Army as a whole 82 per cent. of the total strength had seen less than five years' service. Invaliding.

II.—NATIVE ARMY.

Sickness and mortality in 1896.

There was less sickness and mortality in the Native Army of India during 1896 than in 1895, which is attributed to the dry and non-malarious character of the year.

The ratios of sickness and mortality among Native troops in the six Commands during 1896 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1896	26,279	809	31	8·52
	1895	24,454	790	30	8·26
Punjab	1896	38,824	766	29	14·37
	1895	41,062	878	33	17·58
Madras	1896	25,009	665	31	8·04
	1895	26,738	660	30	8·38
Bombay	1896	24,707	880	28	8·82
	1895	25,259	889	28	11·12
Corps of Central India and Rajputana	1896	5,062	630	20	10·47
	1895	5,172	595	21	6·77
Hyderabad Contingent	1896	6,970	563	19	7·03
	1895	6,968	617	22	5·74
INDIA	1896	128,826	763	29	10·20
	1895	129,655	794	30	11·60

Of the six Commands the Punjab was again the most unhealthy, though the figures show an improvement on those of 1895. Pneumonia was very prevalent in this force, and the death-rate from it was 6·21 per 1,000, or nearly half of the total mortality.

The chief cause of sickness in the Native Army was ague, which again yielded 36 per cent. of the total admissions. Among the diseases from which the admissions to hospital were higher than in 1895 were influenza, cholera, small-pox, and venereal diseases; while from fevers, pneumonia, other respiratory diseases, and dysentery and diarrhœa, there was a decrease in the admissions. There was more influenza among the Native troops in 1896 than there had been since 1892, and the admission-rate rose from 7·0 per 1,000 of average strength in 1895 to 10·7. From venereal diseases the admission-rate in the Native Army was only 37·2 per 1,000 of strength, as compared with 512 per 1,000 among European troops. Figures under this head are not available for the years before 1877. The ratios run at a much lower level than those of European troops, and there is not the same tendency to increase. Only once since 1877 has the ratio reached 40 per 1,000, that was in 1890, when the admission-rate was 41·1.

Respiratory diseases were the chief causes of death in the Native Army, and no less than 36 per cent. of the total deaths were due to them. The death-rate under this head was 3·72 per 1,000 of average strength, against 4·87 in 1895. From pneumonia alone the mortality among the Native soldiers (3·14 per 1,000) was about five times as great as that among European troops (0·64 per 1,000). Fevers of all kinds were the cause of 16 per cent. of the total deaths, against 46 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 1·58 per 1,000, while among the European troops the proportion was 0·50. On the other hand, the death-rate from enteric fever among the Native troops was only 0·04 per 1,000, as compared with 6·31 among the European troops. From cholera there were 88 deaths in the Native Army, equal to 0·69 per 1,000 of strength, as compared with 53 and 0·41 respectively in 1895.

The following statement gives the principal statistics of the Native Army arranged in geographical groups for 1896 :— Groups of stations.

	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	2,324	476	20	6·88
Burma, Inland	6,680	982	46	11·08
Assam	1,774	1,149	45	21·98
Bengal and Orissa	3,113	868	36	7·71
Gangetic Plain and Chutia-Nagpur	6,780	598	25	5·46
Upper Sub-Himalayan	16,176	610	24	11·07
Indus Valley and North-Western Rajputana...	14,776	820	27	17·66
South-Eastern Rajputana, Central India, and Gujarat.	12,283	713	26	9·04
Deccan	20,434	785	26	7·34
Western Coast	2,713	607	27	9·89
Southern India	8,736	578	29	7·67
Hill Stations	17,071	1,035	39	10·25

In four of the above groups the daily sick-rate was higher than that for the whole Native Army, and in five the mortality was greater. The highest mortality was that of the Assam group (21·98), which shows an increase of 7·81 per 1,000 on the rate for the previous year.

Of the large stations with a strength of over 1,000, the following recorded the highest death-rates: Nowshera 37·77 per 1,000 of average strength, Manipur 37·66, Peshawar 21·34, Kohat 19·25, and Dera Ismail Khan 19·19.

III.—GENERAL POPULATION.

Vital statistics.

Births were registered throughout all the 10 provinces in India in 1896, and the birth-rates varied between 43·0 and 26·62 per 1,000 of population under registration. The best results were obtained in the Punjab, Berar, Bengal, Bombay, the North-Western Provinces and Oudh, and Assam, their respective rates being 43·0, 38·3, 38·0, 36·7, 35·4, and 33·6. In the remaining provinces the birth-rates ranged between 32·2 in Lower Burma and 26·62 in Coorg. In seven provinces the birth-rates were higher than in the previous year, and in three they were lower. The birth-rates exceeded the death-rates in seven provinces, the excess per 1,000 varying between 11·5 in the Punjab and 0·19 in Coorg. The climatic conditions of the year were not favourable to health, and the recorded deaths rose from 6,163,743 or 28·94 per 1,000 of registered population in 1895 to 6,779,016 or 32·05. With the exception of Berar and Coorg, the mortality recorded in the several provinces was higher than in 1895. Of the chief diseases, cholera was much more prevalent, and the total number of deaths from it rose from 310,797 to 469,667. The increase was spread over eight of the provinces, but the Central Provinces was the chief sufferer, the death-rate from this cause being 5·58 per 1,000, against 1·63 in 1895. There was an increase also in the deaths from fevers, which was participated in by all the provinces except Berar, Madras, and Coorg. In connexion with this cause of death the scheme for the sale of quinine at a low price by postal agency was making steady progress. The mortality from dysentery and diarrhœa was slightly lower than in the previous year; but from small-pox there was an increase of 88,456 deaths.

The deaths from the chief diseases and from all causes in the several provinces were as follow:—

	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1896.	1895.
Bengal	226,824	3·19	13,388	0·19	1,760,225	24·76	47,935	0·67	2,428,830	34·17	31·39
North-Western Provinces and Oudh.	69,147	1·47	42,771	0·91	1,205,964	25·71	40,858	0·87	1,562,894	33·32	29·13
Punjab	5,146	0·25	45,084	2·19	393,535	19·15	13,886	0·68	648,099	31·53	29·29
Lower Burma	2,959	0·66	1,669	0·37	51,521	11·41	7,777	1·72	106,687	23·63	22·40
Central Provinces	52,985	5·58	7,747	0·82	280,760	29·55	29,882	3·41	468,469	49·31	36·75
Coorg	49	0·28	18	0·10	3,552	20·53	323	1·87	4,574	26·43	29·31
Assam	17,042	3·39	5,444	1·09	101,347	20·18	16,004	3·19	182,417	36·33	33·72
Madras	47,847	1·5	9,410	0·3	260,769	8·0	24,802	0·7	675,787	20·6	19·6
Bombay	35,404	1·88	6,443	0·34	412,229	21·90	36,046	1·92	596,472	31·69	28·61
Berar	12,264	4·3	810	0·3	61,931	21·8	17,722	6·2	124,787	43·8	49·9
Total	469,667	2·21	132,784	0·62	4,531,833	21·36	235,235	1·11	6,799,016	32·05	29·94

Bengal.

The year 1896 in Bengal was particularly unhealthy. The rainfall being deficient and unseasonable affected the crops, resulting in widespread scarcity and high food prices. The birth-rate was higher, though still considerably below the estimated birth-rate for India of of 48·8 per 1,000. The number of births registered in the province rose from 2,458,623 or 34·59 per 1,000 of population in 1895 to 2,703,486 or 38·03, the latter being made up of district rates varying from 48·98 in Noakhali and 47·02 in Faridpur to 25·82 in 24-Parganas. Of the 46 districts there was an increase of births in 38, the greatest advance being in Cuttack, where the ratio was 13·26 per 1,000 in excess of the previous year. Faridpur came next with an increase of 10·45, followed by Dacca with an increase of 8·61, and Monghyr of 8·10. In seven other districts there was an improvement ranging from 7·81 to 5·64 per 1,000. In rural areas the birth-rate was 38·64 per 1,000, and in towns 26·18, as compared with 35·13 and 23·91 respectively in 1895. Out of 147 towns only 11 returned a birth-rate in excess of 40 per 1,000, while 22 rural areas returned rates of over 50 per 1,000, and 63 others over 45 per 1,000.

The total number of deaths registered during the year under notice was 2,428,830 or 34·17 per 1,000, as compared with 2,231,458 or 31·39 in 1895. There was thus an excess of births over deaths of 274,656 or 3·86 per 1,000. The district death-rates ranged from 51·43 in Darjeeling to 23·75 in Sonthal Parganas. In urban areas the rate of mortality rose from 34·46 to 36·14, which was made up of ratios varying from 58·30 in the small municipality of Bhadreswar in Hooghly to 15·70 in the municipality of Maniktola in the 24-Parganas. Twenty-two out of the 147 towns returned a death-rate in excess of 44 per 1,000, while 19 returned rates below 25 per 1,000. "In a year of "general unhealthiness like that under report," the Sanitary Commissioner (Dr. Dyson) remarks, "it is probable that in most of the districts of the province the death-rate "was very near, if not in excess of, the normal estimate of 44 per 1,000. I am afraid, "therefore, that in those places which have returned low rates, there is no other "explanation than defective registration." In rural areas the death-rate rose from 31·24 to 34·07, the highest mortality for such areas being recorded in the districts of Darjeeling (53·07), Muzaffarpur (46·75), Backergunge (44·07), Darbhanga (41·58), Patna (41·19), Rajshahi (40·49), Jailpaiguri (40·0), and Champaran (40·0), cholera and fevers being the chief causes of these high rates.

Of the chief death causes cholera was widely prevalent in 1896, and the number of deaths registered from it was 226,824, or 3·19 per 1,000, against 177,087 or 2·49 in 1895. Every district was affected by the disease, but the mortality varied greatly, and the number of villages attacked was 27,460, or 12·23 per cent. of the total, against 24,103 or 10·72 per cent. in 1895. Eight districts recorded cholera death-rates of over 5 per 1,000, viz., Muzaffarpur (8·78), Balasore (7·72), Howrah (6·73), Nadia (6·52), Darbhanga (6·24), 24-Parganas (5·83), Khulna (5·72), and Calcutta (5·06); in 26 other districts the rates ranged from 4·75 to 1·15, and in ten districts the rates were below 1 per 1,000. As regards the seasonal incidence of the disease in each of the main geographical divisions of the province, the seasons of highest mortality in Bengal proper and Orissa were March and April. In Behar the rates were highest in May and June; and in Chota Nagpur in May, June, and July. During the year, Dr. Haffkine, with a special staff, was engaged under the Bengal Sanitation Department, in cholera inoculation. A large number of people were inoculated, but "it is difficult to form a confident opinion as to its results "until statistics of its working have been collected on a large scale."

From small-pox the mortality was higher than in 1895, the number of deaths having risen from 13,020 or 0·18 per 1,000 to 13,388 or 0·19 in 1896, an insignificant rate, however, when compared with those from other diseases prevalent in Bengal. The disease was present in all the districts except Khulna, but the only district in which it can be said to have prevailed in an epidemic form is Patna, where the death-rate was 1·20. This district is reported to be very backward in vaccination, and to this cause the high rate of mortality is attributed.

No less than 71 per cent. of the total deaths were recorded under fever, a term which, Dr. Dyson observes, "covers a multitude of complaints in the minds of the village "chaukidar, who is primarily responsible for registration, and it is certain that numerous "deaths are put down to fever which are really due to other causes." The number of deaths reported to have occurred from fever during the year was 1,760,225 or 24·76 per 1,000 of population, against 1,634,254 or 22·99 in 1895. Just over a half of the 46 districts recorded a higher fever mortality than the provincial rate, ten registering a rate over 30 per 1,000. Dr. Dyson says:—"In a year of abnormal meteorological "conditions, such as that under report, when the rainfall was intermittent, and the drying "and wetting of the soil alternate, a high death-rate from fever is a natural consequence. "Thus in most of the districts there was a greater mortality from this cause in 1896 than "in the previous year. As regards the districts that head the list, the fact that they are "subject to the notoriously deadly Terai fever, probably in a great measure explains the "exceptionally high death-rate in them."

From dysentery and diarrhœa 47,935 deaths were registered, equal to 0·67 per 1,000 of population, against 49,871 or 0·70 in the previous year. Of the districts, Darjeeling returned the highest death-rate from these causes (6·69), Howrah came next (4·85), followed by Calcutta (4·35), Balasore (3·25), and Puri (2·57). These five districts have headed the list, though in a different order, for the last four years. The Sanitary Commissioner, however, believes the returns are to a great extent vitiated by deaths from these causes being returned as deaths from fever by the native recorders of vital statistics.

In Calcutta the birth-rate rose from 16·0 per 1,000 in 1895 to 18·4 in 1896. The deaths fell from 27,031 or 39·6 per 1,000 in 1895 to 24,356 or 35·7 in 1896. The decrease

in mortality was due to fewer deaths from fever and small-pox. Cholera was more prevalent than in the previous year, and the deaths from it rose from 2,090 to 3,449. Professor Haffkine's method of inoculation as a prophylactic against the disease was again carried on during the year, and 2,500 operations were performed. There were only 69 deaths from small-pox, as compared with 2,220 in 1895. The deaths from fever were also fewer, the total being 9,564, equal to 14·0 per 1,000 of population, against 11,345 or 16·6 in the previous year. The deaths from dysentery and diarrhœa declined from 3,269 in 1895 to 2,967 in 1896.

North-Western Provinces and Oudh.

Notwithstanding the scarcity and distress which prevailed in certain parts of the North-Western Provinces and Oudh during 1896, the year was fairly healthy. The meteorological conditions of the year were a deficient rainfall and abnormally high temperature, though the dryness of the season was beneficial in districts which usually suffer from effects of excessive moisture. The general inferiority of the autumn and spring harvests, following the poor out-turn of the two preceding years, exhausted to a large extent the resources of the population, and famine being prevalent it became necessary to undertake relief works in several districts.

During the year 1,660,387 births were recorded, giving a ratio of 35·40 per 1,000 of population, as compared with 1,637,235 or 34·90 in 1895. Of the total 48 districts 25 showed a birth-rate above and 23 below the average of the provinces. Etah headed the districts with a birth-rate of 52·76, followed by Bulandshahr 51·14, Agra 49·57, Aligarh 49·49, and seven others recorded rates of over 40 per 1,000. The birth-rate in municipalities was 39·30 against 39·37 in the previous year, and was made up of extremes ranging from 61·41 in Fatehpur-Sikri to 26·44 in Lalitpur. In rural areas the birth-rates ranged from 71·65 in Rasulpur in Muttra district to 10·91 in Kotdwara in Garhwal, the average being 34·91 against 34·29 in 1895.

The number of deaths registered rose from 1,366,443 or 29·13 per 1,000 of population in 1895 to 1,562,894 or 33·32, which was made up of district rates ranging from 67·40 in Jhansi to 22·32 in Azamgarh. The provincial death-rate was exceeded in 22 districts. The town death-rate was 39·11 against 33·46 in 1895, and the rural death-rate 32·59 against 28·58. In several municipalities the rate of mortality was considerably above the average; but the Sanitary Commissioner (Surgeon-Major Thomson) points out that "the "value of the figures as an indication of the sanitary condition of the locality and the "health of the inhabitants is in many instances disturbed by the fact of the existence of "poor-houses, to which many of the famine-stricken occupants came only to die." Nineteen districts and 44 municipalities recorded more deaths than births. Registration was again tested by local authorities, and the results disclosed an omission of 2·73 per cent. on 144,049 births, and 2·37 on 130,219 deaths; and in cases tested by the Vaccination Department the omitted percentages were 1·34 of births and 0·73 of deaths.

Of the chief diseases, cholera was fatal in 17,585 more cases than in 1895, the total deaths from the disease numbering 69,147 or 1·47 per 1,000, as compared with 51,562 or 1·10. Though not excessive, the mortality was considerably above the average, and in some districts the incidence of disease was very severe, especially in Jhansi, Banda, Bareilly, and Naini Tal, with death-rates of 8·95, 5·88, 4·15, and 4·10 respectively. In Banda an outbreak occurred among the people gathered on relief works, and in spite of the exertions made to maintain a pure water supply and efficient sanitary arrangements, and to prevent overcrowding, the disease abated only on their dispersal. More deaths from cholera were recorded in September than in any other month, the number reaching 12,926, which was also almost reached in May (12,480). The disease rapidly declined with the cold weather, and almost entirely disappeared in December, when only 226 deaths were reported. All the large fairs in the province passed off without the appearance of epidemic disease.

From small-pox there was a considerable rise in mortality, the deaths reaching 42,771 or 0·91 per 1,000 against 1,968 or 0·04 in 1895. An increase was anticipated by Dr. Thomson on account of the large proportion of the population being still unprotected. Children were the chief sufferers, though a large number of adults succumbed, among whom Dr. Thomson states, "no doubt were many persons who had been vaccinated, but "in whom the effect of the preventive virus had worn out. The remedy of course is "revaccination, and great efforts have been made to extend such operations. But con-"siderable difficulty is experienced in persuading adults to submit to revaccination, "principally because it temporarily cripples them and prevents them following their "usual occupations." The highest district death-rates from small-pox were 4·10 in Allahabad, 3·85 in Unao, 2·39 in Bareilly, and 15 other districts recorded ratios of over 1 per 1,000.

To fevers were ascribed 77 per cent. of the total deaths. The mortality from fever in 1896 was much higher than in 1895, the number of deaths having risen from 1,093,212 or 23·31 per 1,000 to 1,205,964 or 25·71. Among the districts, Pilibhit came first with a fever death-rate of 48·11, followed by Naini Tal (which includes the malarious Tarai) with 45·48, and Bareilly and Hamirpur with 40·88 and 40·54 respectively. Five other districts recorded ratios over 35 per 1,000, five over 30, and 12 over 25. The mortality was higher in every month up to September than during the same period in a normal year, but much lower in the three following months than it usually is. This is attributed to the fact "that many districts in a normal year severely visited by malaria in the "autumn, escaped this year (1896) with very little mortality from this cause."

The deaths from dysentery and diarrhœa during 1896 numbered 40,858, a decrease of 1,920 on the mortality of the previous year, the death-rates being 0·87 and 1·00 respectively. As usual, the hill tracts suffered most. High but not excessive rates were also recorded by Jhansi, Hamirpur, and Banda, and were attributed to large numbers of the people in these districts living on relief works in temporary huts. Kashipur town, in Naini Tal district, again had an exceptional amount of dysentery and diarrhœa, and its death-rate under this head was 16·37 against 12·84 in the previous year.

Though the year 1896 in the Punjab was not a year of plenty it was comparatively healthy. The number of births registered was 884,692 or 43·04 per 1,000 of population, as compared with 901,584 or 43·86 in 1895. The birth-rate was still higher than that of any other province in India, and was made up of district ratios ranging from 51·9 in Gujranwala to 17·4 in Simla and 30·0 in Peshawar. Further improvement was made in the registration of births in the frontier districts. The provincial birth-rate exceeded the death-rate by 11·5 per 1,000 of population, and in ten districts the excess was very considerable ranging between 22·5 and 16·2 per 1,000; while there were only three districts (Umballa, Kangra, and Simla) in which the deaths exceeded the births. **Punjab.**

From all causes 648,099 deaths were registered during the year, giving a death-rate of 31·53 per 1,000, against 601,972 or 29·29 in 1895. The highest district rates were reported from Umballa 40·9, Karnal 40·4, Kangra 40·3, and Rawalpindi 39·6, the remainder varying between 36·3 in Delhi and 22·9 in Gujrat. Although there was scarcity throughout the province in the latter part of the year, owing to deficient rainfall, there were only three deaths from actual starvation. "The preparations to meet any widely-"spread famine were timely," the Sanitary Commissioner, Dr. Roe, states, "and relief "was afforded to many persons who otherwise would have felt the high prices of grain "very severely."

Of the principal diseases, cholera was more prevalent in 1896 than in the previous year, the number of deaths having risen from 549 or 0·03 per 1,000 to 5,146 or 0·25. Nine of the 31 districts were free from the disease, and in the remainder it was severe only in Rawalpindi district, where 2,374 occurred, being equal to a death-rate of 2·38 per 1,000. Cholera is reported to have spread by means of human intercourse from the Nurpur fair, about eight or nine miles from the town of Rawalpindi. "Whatever may have been its "mode of introduction at the fair," Dr. Roe states, "the disease by the dispersion of the "pilgrims spread rapidly all over the district of Rawalpindi and the neighbouring one of "Peshawar." With the exception of a single case of cholera, which was taken out of the train at Ludhiana in April, the entire province was quite free from it until May, in which month 1,245 deaths were recorded, falling in June to 1,206, and each other month, until in November there were only 33 deaths and in December one.

The province was visited by a most severe epidemic of small-pox during the year, resulting in a mortality of 45,084 and a death-rate of 2·19, which is the highest reached in any year since 1879, when the deaths numbered 59,489, and the death-rate amounted to 2·83. The epidemic broke out in a virulent form in December 1895, when 2,088 deaths were reported; the number increased each month until May, when the maximum of 8,047 was reached. From that month there was a steady fall in the mortality until the cold weather set in, when the mortality began to rise again. All the districts were affected, but the epidemic was most fatal in Ferozepore, with a death-rate of 5·75 per 1,000, followed by Gurgaon, Umballa, Montgomery, and Shahpur, with ratios of over 4 per 1,000 each, and by five others whose death-rates were above 3 per 1,000. Of the total 45,084 deaths from this disease 29 per cent. were infants under one year of age, and 59 per cent. were children between the ages of 1 and 12, facts which show that a large number of children must have been unprotected. Steps have been taken with the view of increasing vaccination in the districts of greatest small-pox mortality.

The deaths ascribed to fevers numbered 393,535, giving a death-rate of 19·15 per 1,000, against 392,118 or 19·08 in 1895. The provincial rate was exceeded by 16 out of the

total 31 districts, the highest being Kangra 29·16, Umballa 25·74, Rawalpindi 25·20, and Rohtak 24·55, the remainder ranging from 23·66 in Karnal to 9·08 in Montgomery. In January, nearly twice as many deaths were recorded under this head than in any other month of the year. "This curious fact," Dr. Roe observes, "appears to be due chiefly to "erroneous classification, for from my personal experience of the province I feel satisfied "that the majority of deaths reported in January as due to fevers were really caused by "pneumonia and chest complaints. Wherever a rise in temperature is observed it is simply "called 'fever' by the ignorant villager, and reported as such, and until our system of "disease and death registration is much more perfect we must be content to accept "'fever' as a general term including a large proportion of purely chest disorders."

From dysentery and diarrhœa 13,886 deaths were registered, being equal to 0·68 per 1,000 of population, against 15,648 or 0·76 in 1895. Twelve districts recorded a higher mortality under this head than the provincial rate, the highest being Simla 3·26, Gurgaon 1·41, Kangra 1·27, Delhi 1·25, Gurdaspur 1·09, Umballa 1·00, Karnal 0·99, and Hissar 0·91.

Central Provinces.

The year 1896 in the Central Provinces was one of exceptional drought and failure of the crops, "which had a disastrous effect on the public health and the prosperity of the "people." Owing to the failure of the rabi harvest and consequent high price of food relief operations became necessary early in the year, and until its close large remissions and suspensions of revenue and rent were granted. The vital statistics of the year were the most unfavourable ever recorded. The registered births were fewer by 16,005 than in 1895, the number having declined from 317,432 or 33·41 per 1,000 to 301,427 or 31·72, the lowest rate recorded since 1881, and the lowest of all provinces in India except Madras. In 14 of the 20 districts fewer births were registered than in the previous year, and in the six showing an increase the numbers had considerably declined in 1895 on the figures of 1894. Various reasons have been adduced for the decrease. "It is remarkable," the Chief Commissioner remarks, "how closely the maximum falling-off in the birth-rate corresponds "with the area of maximum harvest failure and consequent distress. It would seem that "a remarkably short birth-rate may be expected as almost conclusive evidence of the "prevalence of pressure on the labouring population."

The deaths of the year numbered 468,469 or 49·31 per 1,000, against 349,137 or 36·75 in 1895. This high mortality has only once been approached within the previous ten years, the death-rate of 1889 having been 43·79 per 1,000. In both years the abnormal mortality was in great part due to widespread and destructive epidemics of cholera and fever. The provincial death-rate was exceeded in seven districts, viz., Damoh (88·28), Mandla (73·68), Saugor (72·63), Jubbulpore (63·16), Seoni (61·94), Narsinghpur (55·48), and Balaghat (49·99). In these districts distress was prevalent, culminating towards the end of the year in acute famine.

The meteorological features of the year were also favourable to the development of the chief diseases from which the people suffered. Owing to the exceedingly dry and hot spring and summer cholera was exceptionally prevalent, and was fatal in 52,985 cases as compared with 15,506 in 1895, the death-rates being 5·58 and 1·63 respectively. The disease prevailed in every district of the province, but it was most severe in Mandla (15·75), Bilaspur (10·99), Damoh (9·58), Seoni (9·48), and Raipur (9·00). Only in the two districts of Hoshangabad and Burhanpur was the mortality less than 1 per 1,000. May and June were the most fatal months, when 12,935 and 14,000 deaths were recorded.

From small-pox the deaths rose from 6,644 or 0·70 per 1,000 in 1895 to 7,747 or 0·82. The disease was widespread and affected every district without exception. In proportion to population the districts of Wardha, Chandla, Betul, Seoni, and Bhandara suffered most, their ratios of mortality being 2·63, 1·78, 1·47, 1·35, and 1·30 respectively. In no other district was the mortality above 1 per 1,000. The disease prevailed with the greatest intensity in the hottest month (May) of the year, and declined with the approach of the rains, and this is the general experience of other provinces. Of the total small-pox deaths one-fourth occurred among infants, and nearly a half were children under 12 years of age.

Nearly 60 per cent. of the total deaths were ascribed to fevers, and the number registered during the year was 280,760 or 29·55 per 1,000 of population, against 221,418 or 23·30 in 1895. The provincial death-rate from fever was exceeded by ten districts, with ratios of mortality ranging from 58·11 to 31·34. The average town death-rate under this head was 22·65, against 19·32 in the previous year. The unseasonable drought of the months of September and October favoured the development of fevers to an unusual degree, "and "it is certain," it is stated, "that forms of disease classed under this denomination

" prevailed to an exceptional extent, not only among those who suffered from privation, " but among the well-to-do as well, during the last quarter of the year."

From dysentery and diarrhœa the registered mortality rose from 20,316 or 2·14 per 1,000 of population in 1895 to 29,882 or 3·14. It is pointed out that during seasons of scarcity bowel complaints are always exceptionally prevalent, when the poor resort to unwholesome and unsuitable food. The highest death-rate under this head was recorded by the Jubbulpore district (9·79), followed by Damoh (9·36), Murwara (9·18), and Mandla (7·68).

Progress continues to be made in Burma in the registration of births and deaths. In the area under registration in Lower Burma 145,688 births were recorded in 1896, giving a birth-rate of 32·27 per 1,000 of population, as compared with 131,147 or 29·04 in 1895. That there is still much room for improvement is shown in the variations in the district rates, which ranged from 42·84 in Pegu to 17·91 in Rangoon. The number of deaths registered was 106,687, giving a death-rate of 23·63 per 1,000 of population, against 101,160 or 22·40 in 1895. By districts the ratios ranged from 16·76 in Mergui to 36·31 in Rangoon. The Sanitary Commissioner (Dr. Sinclair) notices that rural circles returning a low birth-rate usually return a low death-rate, and *vice versa*. " Of " course, infant mortality in prolific communities," he says, " especially in this province " where so little care is taken of the young, must contribute largely to the general death- " rate ; but fertility testifies to prosperity and health, and it is more than probable that " these low birth-rates and low death-rates are largely due to careless registration. " Greater accuracy can hardly be expected from an unpaid agency, but improvement is " expected as the system of appointing ward headmen as registrars becomes general." Burma.

Of the chief causes of mortality that from cholera was much less severe than in 1895, the number of deaths being only 2,959 or 0·66 per 1,000, as compared with 5,150 or 1·14. All the districts except Kyaukpyu and Mergui were affected, and Thayetmyo and Sandoway had only one death each, but the deaths were highest in those of Bassein (596), Myaungmya (441), Thongwa (430), Henzada (410), and Hanthawaddy (289). The disease was present throughout the year, the months of greatest mortality being May, June, and July, when 419, 439, and 598 deaths were respectively recorded. Out of 35 towns 15 escaped cholera altogether. It is reported that nowhere in Upper Burma did the disease appear in an epidemic form during the year.

Deaths from small-pox were slightly more numerous than in 1895, viz., 1,669 or 0·37 per 1,000, against 1,540 or 0·34. Of these, 247 were infants and 814 were children under 12 years of age. The mortality in Henzada district (1·18) was again very high, but this and Hanthawaddy (1·17) and Rangoon (1·13) were the only instances in which the small-pox death-rate reached 1 per 1,000. In the three districts of the Arakan division no deaths were recorded from this disease ; the districts of Mergui and Prome were also exempt, and Amherst and Tavoy had only one death each. Unprotected cooly immigrants from India are, it is stated, a very prolific field for the propagation of this disease, and proposals for remedying the evil were under consideration.

Deaths ascribed to fever rose from 48,049 or 10·64 per 1,000 in 1895 to 51,521 or 11·41, a higher number than had been recorded in any previous year. By districts the death-rate was again highest in Akyab (20·51), Sandoway (15·65), Tharawaddy (15·45), and Prome (14·30). In three other districts the provincial rate was exceeded, and in the remainder the rates ranged from 11·39 to 5·01. The town death-rate from fever was 8·39 and the rural rate 11·87, as compared with 7·57 and 11·08 in 1895.

The deaths registered under dysentery and diarrhœa during the year aggregated 7,777, giving a death-rate of 1·72 per 1,000, against 8,794 or 1·95 in 1895. The highest mortality under this head was recorded by Tavoy, viz., 4·84, followed by Bassein 3·81, Myaungmya 3·58, and Rangoon 3·02 ; in the remaining 14 districts the death-rates ranged from 2·18 to 0·63. Speaking of the difference in the town death-rates from these complaints, ranging from 7·44 to 0·08, Dr. Sinclair remarks :—" Some of these towns get " their water supply from rivers, some partly from rivers and partly from wells, and some " have to rely on wells entirely. No relation between these various sources of supply " and the incidence of bowel complaints is discernible, nor can any be traced in the " sanitary defects or meteorology."

Some slight progress was made in the registration of vital statistics in Assam during 1896. The returns, however, are still far short of the truth. The total number of births registered during the year was 169,172, giving a ratio of 33·69 per 1,000 population, as compared with 155,631 or 31·00 in 1895. The highest birth-rate was again recorded by Goalpara district, viz., 42·71, and the next highest rates were 33·18 and 38·02 respectively Assam.

registered in the Cachar and Sylhet districts, these being the only three instances in which the provincial rate was exceeded, as the rates of the remaining districts ranged from 32·06 in Lakhimpur to 24·57 in Nowgong.

The deaths registered during 1896 aggregated 182,417, exceeding the births by 13,245 and the mortality of 1895 by 13,113. The death-rate was 36·33 per 1,000 of population, as compared with 33·72 in 1895. In the Surma Valley, comprising the districts of Cachar and Sylhet, the average mortality rose from 32·37 in 1895 to 35·43. The increase, however, was entirely in Sylhet, the death-rate in Cachar having fallen from 32·01 to 30·72. In the Brahmaputra Valley the average death-rate was 37·39, as compared with 35·33 in the previous year. Of the six districts in this division Nowgong recorded the highest mortality of 45·70 per 1,000, followed by Goalpara with 42·11, the ratios of the remaining four districts ranging from 40·52 to 29·39.

Cholera was somewhat less fatal than in 1895, the number of deaths having fallen from 18,962 or 3·78 per 1,000 to 17,042 or 3·39. The disease prevailed throughout the year and visited every district. Some of the districts recorded a very high cholera death-rate, notably Nowgong in the Brahmaputra Valley (4·22), which recorded the lowest mortality in 1895 (0·91). In the Surma Valley districts of Cachar and Sylhet the rates were respectively 2·96 and 3·86, both being higher than the rates of the previous year. The average death-rate from cholera in the towns was 5·50 per 1,000, nearly double that among the rural population. In some of them this ratio was greatly exceeded, especially by the Sadr towns of Tezpur, Dhubri, and Silchar, which registered cholera death-rates of 26·18, 22·38, and 14·09 respectively.

Cholera was very prevalent among tea-garden coolies who travelled up the Brahmaputra and Surma rivers in the early parts of the year, and 302 deaths from the disease occurred among the coolies who were landed during the year at the depots at Silchar, Dhubri, Gauhati, and Tezpur. Some of the civil surgeons, it is stated, are inclined to attribute the outbreaks of the disease in a large measure to the influx of tea-garden coolies, but the Chief Commissioner accepts the opinion, which has generally been held, that cholera is endemic in the province, and that its prevalence amongst the indigenous population is not due to any marked extent to importation from other provinces.

Small-pox was more prevalent than in the previous year, the deaths numbering 5,444 or 1·09 per 1,000, against 3,849 or 0·77. The highest rates were returned by Lakhimpur (4·16), Kamrup (2·91), and Sibsagar (2·24), all three showing a marked increase on the previous year's rates, which were 0·76, 1·11, and 0·08 respectively. In the Sadr and divisional towns, in most of which vaccination is compulsory, the small-pox death-rate fell from 5·35 to 1·27 per 1,000, the decrease being due chiefly to the great improvement in Barpeta, a town of about 12,000 inhabitants (where vaccination is not compulsory), which recorded 60 deaths or 5·05 per 1,000, against 433 or 36·43 in 1895. The disease was also severe in Lakhimpur town (4·82). Of the total small-pox deaths, 20 per cent. occurred among infants, and 53 per cent. among children between the ages of 1 and 12 years.

Over 55 per cent. of year's mortality were ascribed to fevers, including kala-azar. The number of deaths registered from them was 101,347, representing 20·18 per 1,000 of the population, against 92,359 or 18·39 in 1895. The increase occurred chiefly in Kamrup where the death-rate rose from 17·62 in 1895 to 25·88. But the highest fever death-rate was again recorded by Nowgong, viz., 36·31, followed by Goalpara 32·98, and Darrang 28·29. Of the 15,637 kala-azar deaths, 10,588 occurred in the Nowgong district, an increase of 257 on the number of the previous year. Owing to the high mortality from kala-azar in Nowgong, and its continued prevalence in other places, a specialist (Surgeon-Captain Rogers) was appointed to investigate and report on the disease. His report was under the consideration of the Chief Commissioner. The general conclusion come to by Dr. Rogers is that the disease is a very intense and epidemic form of malarial fever, and that it is communicable. He recommends the segregation and quarantine of infected persons and places, and the removal to new sites of houses in which cases of the disease have occurred.

Under dysentery and diarrhœa 16,004 deaths were registered, yielding a ratio of 3·19 per 1,000 of population, as compared with 15,523 or 3·09 in 1895. As usual, these diseases were most prevalent in Lakhimpur district, its death-rate under this head being 7·16. The next highest rates were 4·76 and 4·58 in the Cachar and Sibsagar districts. The provincial ratio was also exceeded in Sylhet district (3·45), and Khasi and Jaintia Hills district (3·97).

Madras.

The number of births registered during the year was 979,981 or 29·9 per 1,000, against 976,572 or 29·1 in 1895. The increase was spread over 12 of the 22 districts.

Excluding Madras town, which recorded a birth-rate of 41·5, Chingleput again registered the highest ratio of 39·5, and in ten other districts the rate was above 30 per 1,000, while in Malabar and Godavari the rates were only 22·5 and 25·8 respectively. Among the 57 municipalities, 17 recorded birth-rates over 40 per 1,000, in 31 the rates ranged between 30 and 40 per 1,000, and in seven others between 20 and 30. The mortality in 1896 exceeded that of the previous year by 17,068, the deaths having risen from 658,719 or 19·6 per 1,000 to 675,787 or 20·6. By districts the highest death-rate was, as usual, recorded in Madras, viz., 38·2: "a result which may be partly ascribed to the "greater accuracy of the returns, and partly to the insanitary condition of that city." In the other districts the mortality ratios ranged from 27·0 per 1,000 in the Nilgiris to 15·7 in Malabar. The average death-rate of the towns was 29·0 per 1,000, and that of rural areas 19·9.

Of the chief diseases, cholera was considerably more fatal than in 1895, the number of deaths having risen from 21,172 or 0·6 per 1,000 to 47,847 or 1·5. All the districts were affected, but the disease was most fatal in Bellary and Coimbatore, which recorded 4,205 and 10,731 cholera deaths respectively. The average death-rate in municipal and other towns from the disease was 2·3 per 1,000, against 0·8 in 1895, and that in rural tracts 1·4, against 0·6. Of the 57 municipalities, eight enjoyed immunity from the disease, while in 11 others the deaths did not exceed ten in each. On the other hand, some suffered very severely, notably Kilakarai in Madura with a cholera death-rate of 60·6, and Ambur in North Arcot with 23·4.

Small-pox deaths were reported from all the districts, and the total in the whole Presidency aggregated 9,410 or 0·3 per 1,000, against 5,111 or 0·1 in 1895. Of the districts, the disease was severe in those of Kurnool, North Arcot, and Ganjam, which recorded death-rates of 1·8, 1·2, and 1·2 respectively. In no other district did the mortality reach 1 per 1,000. Of the total 9,410 small-pox deaths 2,245 or 24 per cent. occurred amongst children under 1 year of age, and 3,632 or nearly 39 per cent. among those between 1 and 12 years of age.

From fevers the registered deaths showed a decrease of 16,568 on the previous year, the number having fallen from 277,337 or 8·3 to 260,769 or 7·97. The highest district rates were recorded in the Nilgiris (19·5), Kurnool (15·4), Vizagapatam (15·3); three other districts had ratios of over 10 per 1,000 and twelve over 5 per 1,000. Eight of the 57 municipal towns returned fever death-rates exceeding 10 per 1,000, the highest being 16·5 in Karur, followed by 13·8 in Tirupati and 13·6 in Madras. As compared with the previous year the fever death-rate of the town of Cuddapah fell from 18·3 to 10·2, which the Sanitary Commissioner (Dr. King) ascribed to the deficiency of the monsoon; while that of Karur rose from 10·6 to 16·5, which is attributed to the saturation of the subsoil of the town with soakage from cesspools.

The number of deaths registered under dysentery and diarrhœa in the Presidency was 24,802 or 0·76 per 1,000, an increase of 865 on the mortality of 1895. Of the districts, Madras came first with a death-rate from this cause of 5·3, against 4·9 in the previous year, followed by Chingleput, with 2·1 against 1·9. Regarding Chingleput, Dr. King writes: "This district is notorious for bowel affections. The increase may be due to a "better rainfall in certain parts of the district than it has had for some years past, "bringing about access of water to tanks from more than usually distant parts, and with it "filth, that would have been out of range of influence in ordinary years, or to fluctuation "of the subsoil water beyond normal limits." Of the towns, Coonoor recorded a death-rate under this head of 7·9 per 1,000, and Tanjore, Vizagapatam, Calicut, and Tuticorin of over 6 per 1,000 each.

Bombay.

The year 1896 in the Bombay Presidency was an unhealthy one. "In the early part "of the year," the Sanitary Commissioner (Surgeon Lieutenant-Colonel Clarkson) writes, "there was an outbreak of small-pox, chiefly in the Western and Gujarat Registration "Districts. Then cholera appeared in the Western, Central, and Southern Registration "Districts, and the mortality was largely in excess of last year. The outbreak was most "severe during July and August. Upon this, towards the middle of the rains, occurred "the outbreak of plague in Bombay City, and then, owing to the early cessation of the "rain, widespread scarcity necessitating the opening of famine works began."

In the Presidency, including Sind, 691,847 births were registered during the year, giving a birth-rate of 36·76 per 1,000 of population, as compared with 674,304 or 35·83 in 1895. Of the 24 collectorates and districts 16 recorded higher rates than in the previous year. Seven districts recorded birth-rates over 40 per 1,000, the highest being 47·55 in Ahmednagar, 47·30 in Khandesh, and 46·94 in Nasik. Hyderabad and Bombay City

returned the lowest rates, viz., 18·35 and 19·35 respectively. More children were registered as still-born in Bombay City than in any other district, and the percentage of still-born to born alive was 10·17. "I am still of opinion," the Sanitary Commissioner states, "that overcrowding on unhealthy areas and living in badly ventilated rooms are "the causes of this, to which may be added the kind of work women have to labour at."

The total number of deaths registered in the Presidency rose from 538,540 in 1895 to 596,472, and the rate per 1,000 of population from 28·61 to 31·69, which was made up of ratios ranging from 43·76 in Nasik to 17·46 in Hyderabad. The increase of 57,932 deaths was spread over all the districts except three—Ahmednagar, Sholapur, and Satara—and was common to all the specified causes of death. The excess was most marked in Broach and Kaira districts and Bombay City, the death-rates of which rose from 27·43, 26·93, and 30·58 respectively in 1895 to 39·98, 37·76, and 40·99. The month of greatest mortality was July, when 58,948 deaths were registered, and the last four months were the healthiest, notwithstanding that plague was in Bombay in the last quarter of the year.

Of the chief diseases, cholera caused 35,404 deaths, giving a ratio of 1·88 per 1,000, as compared with 8,890 or 0·47 in 1895. The province of Sind was practically free from cholera, only 5 deaths being reported from one district (Thar and Parkar) during the year. All the other districts were affected, though the epidemic was severe only in those of Bijapur, which returned a death-rate of 6·59 per 1,000, Poona 5·97, Ahmednagar 3·26, Belgaum 3·10, Satara 3·03, and Kolaba 2·08. Many of the towns, however, recorded much higher rates, especially Athni in Belgaum (13·05), Gogo in Ahmedabad (11·30), and Godhra in Panch Mahals (9·12). Deaths occurred in every month of the year, the months of greatest prevalence being April to September inclusive, the maximum of 9,772 being reached in July.

Small-pox deaths rose from 2,229 or 0·12 per 1,000 in 1895 to 6,443 or 0·34. Every district was affected, and all except four showed an increased mortality as compared with the previous year. In no district, however, did the death-rate reach 1 per 1,000, the highest rate recorded being 0·94 in Khandesh. According to age, 29·50 per cent. of the small-pox deaths occurred among infants under one year of age, and 51·78 per cent. among children between the ages of 1 and 12.

The number of deaths registered in the Bombay Presidency as due to fevers was 412,229 or 21·90 per 1,000 of population, against 388,848 or 20·66 in 1895. The average rate of 21·90 was exceeded in 10 districts, among the highest being 33·23 in Broach, 30·33 in Nasik, 30·20 in Kaira, and 29·63 in Khandesh. The increase of 23,381 was shared in by 18 out of the 24 collectorates. In each of the first seven months of 1896, from January to July, the fever mortality was above that of the corresponding months of 1895, and in each of the last five months it was lower. Of the five registration districts in the Presidency, the Western, Gujarat, and Sind districts recorded a higher mortality than in 1895. In the Gujarat Registration District the excess mortality amounted to 20,876, the largest portion of which occurred in the first months of the year, while in the last three, "the recognised "months of malaria," the increase was slight. Regarding the increase in this district, the Deputy Sanitary Commissioner observes: "During the first nine months of the year "small-pox and cholera were prevalent throughout the district, and it is possible that "many deaths due to one or other of these diseases were entered as deaths from fever. "Moreover, there are many villages in which every death is returned as due to fever, and "consequently in such villages a large proportion of deaths must be wrongly entered. It "is worthy of note that during the last three months of the year, when malarial fever is "most prevalent, the returns for the two years, 1895 and 1896, correspond fairly "accurately, while the large divergence occurs in the latter part of the cold weather when "deaths from chest affections are most liable to occur, and in the hot weather and first "months of the monsoon when epidemic diseases are most prevalent."

The number of deaths ascribed to dysentery and diarrhœa aggregated 36,046 or 1·92 per 1,000 of population, against 35,348 or 1·88 in 1895. In 17 collectorates out of 24 the mortality was higher than in the previous year, the greatest increase being in Nasik, where the death-rate under this head rose from 3·64 to 4·73. Of the 7 collectorates showing a decrease, the most marked instance was Sholapur, where the rate of mortality fell from 4·34 to 2·36.

In the latter part of the year under notice plague was declared to exist in Bombay Presidency. The disease first appeared in Bombay City, and by the end of the year it had extended to several districts, and resulted, according to figures furnished by the Sanitary Commissioner, in 2,908 cases having been reported, of which 2,086 were fatal, giving a death-rate of 0·12 per 1,000 of the population. The vast majority of the deaths

(1,803) occurred in Bombay City. An interesting account of the progress of plague during the year, and of the measures taken to suppress it, will be found in the Abstracts of the Reports of the Sanitary Commissioners with the Governments of India and Bombay, pages 104–109 and 165–169 respectively.

Berar.

In spite of a very hot season, a deficient and unseasonable rainfall, and at the close of the year a rise of prices which was sufficient to cause distress to all the poorer classes, the health of the year 1896 in Berar shows a considerable improvement on the previous year. The total number of births registered in the course of 1896 was 109,013 or 38·3 per 1,000 of population, showing an increase of 3,061 or 1·1 on the previous year. But although there was a rise in the provincial birth-rate as compared with 1895, and a considerable improvement over 1894 (33·3), the rate of 1896 was still below the average for the last decennial period (40·7) and much less than the estimated birth-rate for India (48·8). In the six districts of the province the birth-rates ranged from 44·1 in Buldana to 31·8 in Wun, but all recorded a lower rate than in 1895, except Wun and Basim, where there was an increase of 6·4 per 1,000 in the former and of 7·2 in the latter.

The deaths fell from 141,937 or 49·9 per 1,000 in 1895 to 124,787 or 43·8. Although showing a decrease of 6·1 per 1,000, the rate of the year under notice was still considerably in excess of the average of the decade, and 5 per 1,000 above the mean of the preceding five years. The improvement occurred chiefly under fevers and dysentery and diarrhœa, together accounting for a decrease of 11,002 deaths. Wun district recorded the highest death-rate (50·5); Amraoti came next with 45·6; the former being in excess of the ratio of 1895, while the other district rates were lower, especially Buldana and Basim, where there was a falling off of 16·2 and 15·9 respectively. In towns, the average death-rate fell from 46·4 in 1895 to 44·0, which was made up of ratios ranging from 65·7 to 23·5. In 6 towns the mortality was excessive, varying between 65·7 and 50·3 per 1,000.

Cholera was again epidemic during the year, and was the cause of 12,264 deaths or 4·3 per 1,000 of population, against 11,919 or 4·2 in 1895. The disease affected every district, and prevailed throughout each month of the year. According to districts, the highest death-rate was again recorded in Basim, where there were 2,891 cholera deaths, equal to a ratio of 7·3 per 1,000, against 3,976 or 10·0 in 1895. Wun came next with a death-rate of 6·9. The mortality from cholera was more than double that of the decade, and has only been exceeded four times in 26 years. The average urban and rural death-rates from cholera were 5·3 and 4·2 per 1,000 respectively. Of the 37 towns only five escaped the disease, and in 21 of these the death-rates exceeded the average for the province. Out of a total of 5,658 villages cholera prevailed in 704 or 12·4 per cent., as against 611 in 1895.

From small-pox, 810 deaths were registered, giving a ratio of 0·3 per 1,000 of population, as compared with 566 or 0·2 in 1895. More than half the deaths (415) were registered in Amraoti district, and the fewest (12) in the Basim district. Although the disease was present in many circles, it attained serious proportions in very few. Of the total small-pox deaths, 257 occurred in the towns and 553 in rural circles. Sixty-nine per cent. of the deaths occurred amongst children under 12 years of age, 162 or 20 per cent. being infants under one year. It is reported that the returns of Amraoti district were "swelled by cases of influenza under the name of *Kapsi matha*, which means "'cotton-pox,' the natives apparently connecting the disease with the unusually abundant "crop of cotton."

Under fevers, a mortality of 61,931 or 21·8 per 1,000 was registered, against 66,203 or 23·2 in 1895. By districts the death-rates from fever varied between 33·8 in Wun and 16·1 in Buldana. For the first five months of the year the fever mortality was unusually high, and was attributed to influenza.

The number of deaths attributed to dysentery and diarrhœa was 17,722 or 6·2 per 1,000, which was less by 6,730 or 2·4 than the number recorded in 1895. Ellichpur district, as usual, recorded the highest mortality under this head, viz., 10·3, against 13·8 in the previous year. Akola followed with 8·0, which was lower than the ratio (10·3) of the preceding year. The other district rates ranged from 6·7 in Amraoti to 2·7 in Wun.

IV.—JAILS.

Sickness and mortality in 1896.

There was less sickness among the jail population of India during 1896, as compared with the previous year, but a slightly higher mortality. The daily average sick per 1,000 of average strength fell from 42·95 in 1895 to 39·54, and the ratio of admissions into hospital from 1,006 to 939 ; while the death-rate rose from 26·59 to 27·79. There was no material increase in mortality, except in the Central Provinces, where the jail death-rate rose from 55·96 in 1895 to 72·11 in 1896. From cholera there were 142 deaths, as compared with 93 in 1895. In the jails of the Punjab, Assam, and Coorg, there were no deaths from this disease. There were more deaths from fevers, and dysentery and diarrhœa.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1896, as compared with the previous year.

Provinces.	1896.			1895.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,154	39	28·78	1,247	42	27·47
North Western Provinces and Oudh.	897	51	28·83	902	58	27·45
Punjab	1,237	31	15·68	1,451	35	21·81
Burma	759	35	18·19	892	38	17·93
Central Provinces	1,108	40	72·11	922	35	55·96
Assam	1,128	51	50·86	1,287	58	59·21
Coorg	1,042	31	20·85	591	16	42·86
Madras	583	25	19·51	643	26	18·18
Bombay	861	32	31·89	956	30	29·23
Berar	594	18	25·13	877	23	23·26
India	939	40	27·79	1,006	43	26·59

Bengal.

The sanitary history of the Bengal jails for 1896 is not quite so satisfactory as that of the previous year. The year's statistics show that there was less sickness among the jail population of the province, with an increased mortality. The admissions into hospital were in the ratio of 1,154 per 1,000 of average strength, against 1,247 in 1895, the average daily sick-rate was 39 or 3 per 1,000 less, and the death-rate rose from 27·47 to 28·8. Among all classes of prisoners there were 501 deaths, and of these 461 were convicts. The diseases which contributed largely to the convict death-rate (29·0) were dysentery and diarrhœa 134 deaths, respiratory diseases 53, and cholera 60. In the previous year there were only 26 deaths from cholera amongst the convicts. The only serious outbreaks of the disease occurred in the Darbhanga and Bankipur jails, where the deaths from the disease numbered 22 and 12 respectively. Of the convicts who died in jail nearly 28 per cent. were admitted in good health, nearly 37 per cent. in indifferent health, and 35½ per cent. in bad health. Out of 47 jails the average death-rate among convicts was exceeded in 22, the highest being 168·0 in Daltonganj against 51·5 in the previous year, Darbhanga 106·4 against 25·8, Dinajpur 99·4 against 147·8, Barasat 96·8 against 77·6, and Bankipur 87·2 against 22·6. In nine others the mortality ranged from 78·1 to 50·7 per 1,000, and in four more over 40 per 1,000. In four jails there were no deaths. The high mortality of the Daltonganj jail was due to the bad state of health of the prisoners admitted, who had been exposed to privation and were suffering severely from malarial cachexia, four of the eight deaths having occurred within 20 days of admission to jail. The high death-rates at Darbhanga and Bankipur were due to the outbreaks of cholera already mentioned. Excluding the mortality from this disease, the death-rates were 25·7 and 39·6 respectively. At Dinajpur the high mortality was due to the wretched condition of health in which a great number of prisoners were admitted to jail, and at Baraset, which is one of the most malarious sub-divisions of Bengal, the prisoners confined there suffer much from fever. Sanitary improvements continued to be

made in most of the jails, and for the most part consisted in the provision of better ventilation, the substitution of a better class of latrine, and the substitution of lime-washing for the primitive method of cow-dung washing.

North-Western Provinces and Oudh.

The year 1896 in the North-Western Provinces and Oudh was one of much scarcity among the free population, and many of the admissions into the jails were in the last stages of want and emaciation. "The general population," the Inspector General observes, "was below par, and, I think, we may congratulate ourselves on the very small "death-rate and absence of any large epidemics. . . . I venture to say, that no body "of men could possibly pay more attention to the welfare of their prisoners, from a medical "point of view, than the Superintendents of all the jails in these provinces. They one "and all devote their attention most carefully to the health of the prisoners, taking "just as much interest in them as they do in the dispensary cases, and if mortality goes up, "it is due in, I may say, all cases to extraneous causes quite beyond their control." The admissions into hospital fell from 902 per 1,000 of average strength in 1895 to 897, the daily average sick from 58 to 51 per 1,000, while the death-rate rose from 27·45 to 28·83, which is considered to be low, and "shows that every attention was paid to "preserving the health of the prisoners." The mortality would, however, probably have been normal, but for the admission of enfeebled persons in an indifferent state of health. Of the 56 jails in the province, nine recorded a death-rate of over 50 per 1,000, the highest being 105·74 in Chunar temporary jail. Several of the jails showed a distinct improvement in health, chief among them being Moradabad, where, notwithstanding an epidemic of fever which necessitated the temporary evacuation of the jail for two months, the death-rate declined from 137·15 in 1895 to 41·15. The decrease in the death-rate of the unhealthy jail of Banda from 86·14 to 61·60 is also satisfactory. Of the causes of death, cholera in an epidemic form was again fortunately absent, only 14 deaths from the disease having been recorded in 1896, against 9 in the previous year, in all the jails. The mortality from dysentery and diarrhœa was somewhat less. Of the total 951 deaths in the jails 906 were of convicts, the death-rate being 29·43. According to length of residence in jail, the highest mortality occurred among convicts of from one to three years' standing, viz., 35·41, while among those during the first six months of imprisonment the death-rate was 32·71, against 35·26 in 1895.

Punjab.

The year 1896 was a healthy one in the Punjab, and there was less sickness in the jails than in the previous year, and the mortality was lower than in any year except 1868, when it was only 12·9. The admissions to hospital per 1,000 of average strength fell from 1,451 to 1,237, the daily sick-rate from 35 to 31, and the death-rate from 21·81 to 15·68, which is less than half the mortality of the province. "The steady decline during the past five "years in the jail ratios of admissions to hospital, of daily average sick, and of deaths "shows," the Government observe, "that really good work, with increasingly good results, "has been done by the medical officers in charge of jails." The highest death-rate was again returned by the Lahore Female Jail, viz., 50·96, the result of 8 deaths. In five jails there were no deaths, and in 12 the mortality was below 14 per 1,000. In several other jails the death-rates were below the provincial average. Of the total 186 deaths, all but ten were of convicts, giving a death-rate of 16·09. The mortality from dysentery and diarrhœa and from respiratory diseases, the chief causes of death, was lower than it had been at any time during the past 20 years. In 20 jails not a single death from dysentery and diarrhœa was recorded during the year.

Of the 176 deaths among convicts, 65 had not been more than six months in jail, but the highest rate, according to length of residence, was among convicts who had passed above seven years in jail (33·82 per 1,000), though, to some extent, this is accounted for by the 7 deaths being calculated on the small number of 207.

Burma.

The health of the jail population of Burma during 1896 was, on the whole, again satisfactory, and the death-rate was very low though slightly above that of the previous year. Among all classes of prisoners the admissions into hospital were in the ratio of 759 per 1,000, against 892 in 1895, the daily sick-rate was 35 or 3 per 1,000 less, and the death-rate was only 18·19, as compared with 17·93. It will also be observed that the Burma Jail death-rate for 1896 was the lowest of all jails except that of the Punjab, which was 15·68. As was observed last year, apparently no special measures were taken to obtain this satisfactory result, and it must be concluded that the low rate of mortality was in consequence of an intelligent and strict attention to all the ordinary details of jail management. To some extent the greater healthiness of prisoners in this province is accounted for by the people being "on the whole, more healthy and better nourished than

" those in some of the provinces of India." Of the 263 deaths which occurred during the year, 249 were of convicts, the death-rate being 17·75. Cholera was responsible for only 8 deaths, distributed over five jails. Among other diseases, tubercle of the lungs, &c., contributed 63 deaths, dysentery 41, and malarial fevers 14. The jails of the province continued to enjoy complete immunity from small-pox. Six of the jails recorded a higher death-rate than the average, the highest being registered by Bhamo, 108·43 per 1,000; followed by Pagan, 83·33; Mergui, 48·78; and Moulmein, 35·62; but the number of prisoners in these jails, except Moulmein, is small, and a few deaths give a high rate. It is reported that about half the jails in the province were in a chronic condition of overcrowding throughout the year, and that only five were not at one time or another in this state.

Central Provinces. The vital statistics of the jails of the Central Provinces for 1896 are extremely unsatisfactory. The admissions into hospital per 1,000 of average strength rose from 922 in 1895 to 1,108, the daily average sick-rate from 35 to 40 per 1,000, and the death-rate from 55·96 to 72·11, the highest mortality since 1887. These unfavourable results were in great part due to the condition of the new admissions, many of them being in a state of extreme emaciation indicating the effects of prolonged privation and want, and were admitted at once into hospital or the infirm gang. Out of the total number of 404 deaths, more than half (215) were caused by dysentery and diarrhœa, chiefly by a highly fatal and malignant form of the former disease. Six of the nineteen jails recorded a higher mortality as compared with the previous year. Those of Balaghat, Damoh, Narsinghpur, Seoni, Bilaspur, Mandla, and Saugor furnished the highest figures, their ratios ranging from 480·0 to 100·7 per 1,000. Among other diseases, respiratory diseases caused 43 deaths, fevers 11, and cholera 17. In the previous year there were 15 fatal cases of cholera. All but 20 of the 404 deaths occurred amongst convicts, the death-rate being 73·90, against 57·65 in 1895.

Assam. The health of the prison population of Assam in 1896 was better than in 1895. The rate of admissions to hospital declined from 1,287 per 1,000 to 1,128, the daily sick-rate from 58 to 51, and the death-rate from 59·21 to 50·86. The cause of the high mortality in 1895 was specially inquired into by the Chief Commissioner, who came to the conclusion that it was due chiefly to insufficient clothing, and to the absence of proper supervision over convicts employed extra-murally. Orders were issued for placing the whole system of extra-mural labour on a more satisfactory footing, and for the supply of dry and adequate clothing. These orders took effect from the 1st June 1896, and as a result the mortality of the latter half of the year was much lower than would appear from the figures for the year taken as a whole, and a further marked improvement is expected in 1897. Of the total 78 deaths among all classes of prisoners, 25 were due to dysentery and diarrhœa, and 11 to malarial fevers. There were only two deaths from cholera. All but four of the total deaths occurred amongst convicts, the death-rate being 52·46 against 61·68 in 1895. Excluding the lock-ups, the average death-rate of the nine jails in the province was 57·17 per 1,000, as compared with 69·02. Of these nine jails, five returned a higher mortality than in 1895, viz., Sibsagar 92·10 against 33·60, Nowgong 80·63 against 46·33, Gauhati 77·78 against 56·91, Silchar 61·99 against 31·44, and Shillong 58·74 against 45·67. There was ample accommodation as a whole for all the prisoners, and although there was at times overcrowding in some prisons, it was remedied by transferring excess prisoners to other jails.

Madras. There was less sickness among the prisoners in the Madras Presidency in 1896 than in the previous year, but the mortality was slightly higher. The hospital admission rate fell from 643 per 1,000 of average strength to 583, the daily sick-rate was 25, or 1 per 1,000 less, while the death-rate rose from 18·18 to 19·51, but with this exception it was lower than that of any previous year since 1886. The average death-rate of the central jails was again satisfactory, 17·8 per 1,000. The Criminal Leper Ward recorded a death-rate of 71·74, being the result of one death among an average strength of 14, but the most unhealthy jail was Parvatipuram, which recorded a death-rate of 96·06 per 1,000. Owing to the persistent unhealthiness of this jail it was closed during the year, as was also the Cuddapah Jail for the same cause. Rajahmandry Jail returned the next highest death-rate (47·09), resulting from 40 deaths among an average strength of 849. The high mortality in this jail is said to have been due partly to carelessness in the selection of prisoners for particular kinds of labour, and probably also to the want of proper supervision. The matter was being inquired into. Of the remaining 21 jails, the mortality ranged from 33·81 to 12·17 in 16, while in eight

there were no deaths. Dysentery and diarrhœa and respiratory diseases were the chief causes of mortality among the prisoners, the death-rate from the former being 4·90 per 1,000, and from the latter 2·58. From cholera there were only two deaths, one in Pallamcottah Jail and one in Berhampur. Of the total 187 deaths convicts contributed 168, representing a ratio of 20·33 per 1,000 of average strength, as compared with 19·26 in 1895.

Bombay.

The general health of the prison population of the Bombay Presidency during 1896 was less satisfactory than in the previous year. The rate of admissions to hospital per 1,000 of average strength fell from 956 to 861. The daily sick-rate (32) was 2 per 1,000 more, while the death-rate rose from 29·23 to 31·89 per 1,000. Among the convicts the mortality was 33·4 or 1 per 1,000 more than in 1895. Seven out of the 18 jails were overcrowded throughout the year, and of these seven three, the Common Prison, Bombay, and the jails of Shikarpur and Thana, recorded convict death-rates of 42·6, 71·0, and 113·6 per 1,000 respectively. The only other jails which recorded a mortality above the average were the Sind Gang 35·5 and the Deccan Gang 33·7. All but 26 of the total 263 deaths (including 18 in the lock-ups) occurred among the convicts. The chief causes of mortality were—dysentery and diarrhœa 42 deaths, respiratory diseases 66, including 52 from pneumonia, fevers 14, anæmia and general debility 7, and cholera 29. Of the cholera deaths 23 occurred in the Thana jail and formed a third of its mortality. The epidemic broke out in July and continued into the following month. The first two cases occurred among prisoners employed on grinding grain and on cane work. The disease afterwards spread to all parts of the prison. "All possible measures calculated to check and exterminate "the epidemic were adopted, and within just four weeks from the date of the first case the "final seizure was recorded." The cause of the outbreak could not be clearly traced, but the disease is supposed to have been introduced by warders or convicts, cholera having been very prevalent in the district prior to its appearance in the prison. Pneumonia, as usual, was very prevalent in the Sind jails, 94 cases, out of a total of 188, having occurred in them, and 32 of the 52 deaths. Shikarpur was the chief sufferer, with 40 cases and 21 deaths.

Berar.

The vital statistics of the jails in Berar show that the general health of the prisoners in 1896 continued to be satisfactory. The rate of admissions into hospital per 1,000 of average strength declined from 877 to 594; the daily sick-rate also fell from 23 to 18, while the death-rate rose from 23·26 to 25·13. The year was a very healthy one in all districts except Wun, and there were no circumstances connected with the health of the prisoners calling for special notice. There was a marked improvement in the health of the prisoners at Akola, though the mortality (25·72) is still considered to be higher than it ought to be, without any special cause to account for it. Apparently it is influenced by advanced age, for 9 out of the 14 deaths were men of over 55 years of age, the majority being too old and decrepit to battle against illness. The highest mortality was recorded in the Yeotmal Jail, where there were seven deaths among an average strength of 97, giving a death-rate of 71·92. All but three of the 36 deaths occurred amongst convicts, their death-rate being 23·81 per 1,000, as compared with 25·64 in 1895.

V.—VACCINATION.

General results. During 1896-97 there were 7,309,087 persons successfully vaccinated in the several provinces of India, being an increase of 85,496 on the number of the previous year. According to age, over $2\frac{3}{4}$ millions (2,892,039) of the total were children under one year of age, and nearly $3\frac{1}{4}$ millions (3,234,392) were children between the ages of one and six years. The proportion of population protected against small-pox by the year's operations ranged from 55·45 in Coorg and 46·86 in Burma to 28·87 in the North-Western Provinces and Oudh. In the vaccination of infants the best results were, as usual, obtained in Berar, Bombay, and the Punjab, where 66·8, 59·1 and 58·5 per cent. respectively of the children born during the year (estimated at 40 per 1,000 of population) were protected against small-pox. In the Central Provinces the percentage was 47·5, and in the remainder it ranged from 30·9 in Burma and 30·7 in the North-Western Provinces and Oudh to 17·6 in Bengal.

Statement showing the total number of persons successfully vaccinated during the year 1896-97 :—

Province	Population among whom Vaccination was carried on (Census of 1891).	Number of Persons successfully vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Children born during the Year (calculated at 40 per 1,000 of Population) successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	71,053,516	2,213,915	29·62	498,979	1,413,785	17·6
North-Western Provinces and Oudh.	47,146,033	1,362,169	28·87	578,390	566,881	30·7
Punjab	20,724,940	764,466	36·65	485,204	129,549	58·5
Central Provinces	12,228,229	388,689	30·56	232,124	93,667	47·5
Berar	2,897,040	99,991	34·5	77,490	15,647	66·8
Burma	8,146,855	381,797	46·86	105,213	177,009	30·9
Assam	5,644,258	251,568	43·31	45,865	145,955	20·4
Madras Presidency	35,651,577	1,118,203	31·1	330,819	559,657	23·2
Bombay Presidency	22,701,942	718,474	35·34	536 666	128,129	59·1
Coorg	173,055	9,815	55·45	1,289	4,113	18·6
TOTAL	226,357,445	7,309,087	32·24	2,892,039	3,234,392	31·3

Bengal. The total number of vaccinations performed in Bengal during 1896–97 was 2,293,655, of which 2,213,915 were successful, against corresponding figures in 1895–96 of 2,277,081 and 2,200,472. The primary operations numbered 2,223,128, of which 98·50 per cent. were successful. According to age, 498,979 of the successful primary vaccinations were of children under one year of age, and 1,413,785 were between one and six years. For the whole province the successful vaccinations were in the proportion of 29·62 per 1,000 of the population. Estimating the births during the year at 40 per 1,000, the percentage of infants successfully vaccinated was only 17·6, a ratio far below that attained in other provinces. There was, however, an improvement of three per cent. in the protection afforded to infants as compared with the results of the previous year.

Three methods of vaccination are practised in the province—(1) with lymph taken direct from the calf; (2) with calf lymph prepared with lanoline; (3) with human lymph taken by arm to arm transfer. Dr. Dyson again expresses his belief in vaccination direct from the calf, which he is confident will soon entirely supersede the arm to arm method of vaccination which, he says, is objectionable to the people in Bengal.

He gives statistics showing that in many districts the operations performed direct from the calf increased very considerably as compared with the previous year, and remarks :—
"When I suggested vaccination direct from the calf in 1893, instead of the arm to arm "method, I was told that it was impossible in Bengal. I persevered, however, with the "idea, and the above figures show what has been done in the three years which have since "elapsed. I decline to believe that the system is impracticable in the districts which "show no work in this connection."

As regards the attitude of the people, Dr. Dyson stated in his last report that the people seemed to be gradually realising the benefits of vaccination, but that there were still places where vaccination was opposed chiefly on sentimental grounds.

North-Western Provinces and Oudh.

In spite of the prevailing scarcity during the year vaccination continued to make steady progress in the North-Western Provinces and Oudh. The total number of persons vaccinated rose from 1,499,253 in 1895–96 to 1,528,478 in 1896–97, and the successfully vaccinated from 1,343,207 to 1,362,169. The proportion of persons protected by vaccination is, however, still very small, the ratio for the year being only 28·87 per 1,000, which is the smallest ratio attained in any province in India. Primary vaccinations numbered 1,443,741, of which 94·65 per cent. were successful. Of the 1,309,717 successful primary cases, 578,390 were infants and 566,881 were children over one and under six years of age, the former showing a satisfactory improvement as compared with the number of the previous year, and the latter a decrease. Estimating the births at 40 per 1,000 of the population, 30·7 per cent. were successfully vaccinated during the year. But, including the figures for children between one and six years, which show that the arrears of unprotected children remaining at one year of age have been largely overtaken within the last five years, the successful primary vaccinations equalled 78·83 per cent. of the births.

In previous years the areas of operation had been divided for the purposes of control into three circles, each in charge of a Commissioned Medical Officer, acting as Superintendent of Vaccination and Deputy Sanitary Commissioner. From the 1st February 1896 the number of these officers has been reduced, and the areas of control have been re-arranged in two circles.

In the first circle, where in some districts vaccination for years past has been more fully established than elsewhere in the province, the average ratio of success of its 27 districts equalled 30·38 per 1,000 of the population, against a mean for the five previous years of 27·34. In the second circle, the average ratio of its 22 districts was 27·58 against a five years' mean of 20·97. The Vaccination Act is in force in all the municipalities, but in some places it is not worked as efficiently as it should be. The results, however, show a slight improvement on the previous year, the ratio of successful vaccinations per 1,000 of population of the municipalities having risen from 38·15 to 38·55.

Punjab.

The results of vaccination in the Punjab in 1896–97 are not, on the whole, so satisfactory as those for 1895–96. Altogether 902,435 operations were performed, showing a decrease of 18,762 cases as compared with the figures of the previous year. The decrease was almost entirely among primary cases, for the number of re-vaccinations (229,335) was less only by 96. Of the primary cases, 93·22 per cent. were successful. The number of successful cases among children under one year of age fell from 487,217 or 58·8 per cent. of the births, calculated at 40 per 1,900 of population, to 485,204 or 58·5 per cent. The provincial ratio of persons successfully vaccinated per 1,000 of the total population was 36·65, against 37·44 in the previous year. Animal lymph was chiefly used, and during the year over 80 per cent. of the vaccinations were performed with it. The diminution in the returns was in some measure due to a most severe and widespread epidemic of small-pox which visited the province during the year. It is noticed that although the mortality was much smaller in districts in which vaccination is more thoroughly carried on than in others, the high death-rate from this disease for the province (2·19) shows that a large number of persons are in an unprotected state.

Burma.

Considerable progress was made in vaccination work in Lower Burma during 1896-97. The total number of persons vaccinated was 292,892, as compared with 245,065 in the previous year. The increase of 47,827 was contributed by 17 of the 20 districts, but chiefly by Thaton and Henzada, where the excess amounted to 14,982 and 11,877 respectively. The percentage of success in primary operations continued to improve. Out of 268,881 primary cases, 92·01 per cent. were successful, against a corresponding ratio of 91·22 in the previous year. The number of infants protected was 63,918, equal to about 34 per cent. of the births, estimated at 40 per 1,000 of the population.

The Vaccination Act was extended to three more towns during the year. Its benefits are less appreciated in rural tracts, because its efficacy is not so well understood ; but the large increase in the number of operations within the last few years—the successful primary cases having nearly doubled—is a sign " that the popular distrust, such as it is, " is being gradually overcome."

In Upper Burma 130,356 vaccinations were performed during 1896–97, being an increase of 9,678 on the number of the previous year, the excess being spread over 15 of the 18 districts. The quality of the work also showed improvement, the percentage of success in primary vaccinations having risen from 92·63 in the previous year to 93·34. Estimating the births at 40 per 1,000 of population 29·6 per cent. were successfully vaccinated, practically the same as in 1894–95. In the province of Burma as a whole the ratio of successful vaccinations per 1,000 of population was 46·86, as compared with 39·39 in the previous year, and the percentage of infants successfully vaccinated, estimating the births at 40 per 1,000 of population, was 30·9 as compared with 22·0 per cent. in 1895–96.

Central Provinces. Vaccination work in the Central Provinces was considerably restricted during 1896–97 on account of (1) scarcity and widespread distress, (2) falling off in the number of births, and (3) emigration of the people from their villages while in search of employment or the means of subsistence. There were 413,809 persons vaccinated during 1896–97, showing a decrease of 51,666 on the number of the previous year. Primary vaccinations fell from 397,261 to 367,821. The percentage of success in primary cases was 96·20, against 96·22, and the proportion of the total population protected by vaccination was 30·56, as compared with 35·99 in 1895–96. Of the 18 districts in the province, ten showed a decrease in primary operations, and eight an increase. In the protection of infants there was a falling off of 7,741, the number vaccinated under one year of age during the year having decreased from 239,865 to 232,124.

Animal lymph appears to be becoming popular in these provinces, and there is now very little prejudice against it. The Sanitary Commissioner says: "Great progress has "been made in the matter of substituting animal for human lymph. In many districts "lanoline lymph is used effectively. Arm-to-arm vaccination is now practised in very "few places." With the lymph obtained from calves, 240,217 children were vaccinated during the year, and of this number 94 per cent. were successful.

Assam. The results of vaccination work in Assam for 1896–97 compare favourably with those for the previous year. There were 274,696 operations performed by all agencies in the province, which is an increase of 14,006 over the figures of 1895–96. All the plains districts contributed to the increase, but there was a falling off in several of the hill districts, especially in Kamrup (4,298). The largest increase occurred in Sibsagar district (7,971), followed by Sylhet (5,354). Of the total operations 267,171 were primary cases, and of these 96·6 per cent. were successful. The Compulsory Vaccination Act was in force during the year in ten places, their population being 66,313. The number of infants successfully vaccinated was 45,865, representing only 20·4 per cent. of the births, estimated at 40 per 1,000 of the population.

Madras. The aggregate number of vaccinations performed in the Madras Presidency during 1896–97 was 1,247,720, being an increase of 49,549 on the operations of the previous year. Of the total, 1,173,121 were primary cases, of which 92·5 per cent. were successful, against 91·22 per cent. in 1895–96. The number of children under one year of age successfully vaccinated rose from 314,117 to 330,819, which represented only 23·2 per cent. of the estimated births, as compared with 22·0 per cent. in the previous year. Vaccination is compulsory in all municipalities, except the newly constituted municipality of Tiruvannamalai, and the number of operations performed by municipal vaccinators fell from 120,190 to 118,655. In the town of Madras the number of operations performed was 27,021, or three less than in the previous year. Of the 21 districts there was an increase of work in 13, the most marked case being that of Vizagapatam (22,844); this improvement is the more satisfactory as in the previous year Vizagapatam showed the largest falling off (12,207). Animal vaccine was employed both in districts and municipalities, and the total number of vaccinations performed with it was 1,241,843, or only 5,877 less than the total number of operations, and of these 1,113,050 or 89·4 per cent. were successful, the corresponding figures for the previous year being 1,190,541, 1,074,919, and 92·3 respectively. The best results were obtained, as usual, from calf-to-arm vaccination, with a percentage of success of 94·7.

Bombay. Omitting the statistics of five Native States which are not under the supervision of the Bombay Vaccination Department, the out-turn of vaccination work in the Presidency fell from 810,804 operations in 1895–96 to 810,723. This shows a decrease of 81. The total primary cases rose from 732,648 to 736,511; the percentages of success being respectively

93·23 and 93·69. The substitution of animal for human lymph continued to increase in the Presidency. In the City of Bombay vaccination with animal lymph exclusively was carried on throughout the year. Of the 680,033 primary successful cases, nearly 80 per cent. were infants under one year of age. Reckoning the births at 40 per 1,000 of population, 59 per cent. were protected from small-pox. Inoculation was not practised anywhere in the Presidency during the year, and no instances were reported of any disease having been communicated through vaccination.

Berar.

There was an improvement in the out-turn of vaccination work in Berar during 1896-97, the total operations having risen from 106,605 in 1895–96 to 120,111, an increase of 12·6 per cent. The number of primary vaccinations was 98,594, out of which 96·81 per cent. were successful, against 92,694 and a rate of success of 95·94 in 1895–96. Of the total number of successful primary operations, 77,490 were performed on infants under one year of age ; estimating the births at 40 per 1,000 of population, 66·8 per cent. were protected from small-pox. The Sanitary Commissioner continues his statement showing the efficacy of vaccination in checking small-pox mortality in Berar ; the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of five years 1868-69 to 1872–73, to 35·8, the mean of five years ending 1892–93 ; the mortality from small-pox for the same periods has declined from 2·02 to 0·2 per 1,000. The corresponding ratios for 1893–94 were 35·0 and 0·06 per 1,000, those for 1894–95 were 32·2 and 0·37, for 1895–96 the ratios were 31·8 and 0·2, and for 1896–97 34·5 and 0·2 respectively. The Vaccination Act is now in force in all the municipal towns, the Act having been extended to Karinja during the year. It is reported to have worked satisfactorily in all municipal areas.

With regard to the lymph in use in the province, Dr. Little says : " Since I first " entered upon the duties of the Sanitary Commissioner's office in October 1878, animal " lymph obtained from the cow has been more or less used in the province. It was first " tried for the purpose of renewing our supply and starting the season's operations, and " we were thus able to dispense with the annual supplies of English lymph furnished by " Government for this purpose. After a time, when Superintendents and Vaccinators " became more skilled and experienced in animal vaccination, the work of the province " came to be carried on partly with animal and partly with humanized lymph until 1890, " when a scare was raised as to the possibility of transmitting leprosy through the " medium of humanized lymph. Arm-to-arm vaccination was then completely abandoned, " and the work carried on entirely with lymph propagated from the cow or buffalo. The " people of the province were by this time quite accustomed to the idea of cow vaccination which had been thus gradually and quietly introduced, and there was no difficulty " experienced in substituting animal for humanized lymph ; indeed, native feeling had " come to prefer the animal lymph, for they were quick to perceive that their children " suffered less when cow lymph was used ; that it either took or failed without subsequent " ulceration, whereas the arm-to-arm method in the hands of a careless vaccinator not " infrequently resulted in severe ulceration and inflammation of the child's arm. Over " and over again have the villagers told me this, and personally I seldom or ever see now " the ulcerated and inflamed arms which were but too common under the old arm-to-arm " system as practised by uneducated and unprofessional men at a distance from immediate " supervision."

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1896 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1896	455	47,109	2,637,501	2,684,610
	1895	427	45,243	2,434,536	2,479,779
Calcutta and Howrah	1896	16	25,647	258,794	284,441
	1895	12	26,879	266,672	293,551
North-Western Provinces and Oudh	1896	350	62,441	3,892,918	3,955,359
	1895	340	61,514	3,955,681	4,017,195
Punjab	1896	267	62,877	3,070,117	3,122,994
	1895	257	56,172	3,204,445	3,260,617
Burma	1896	96	30,929	677,560	708,489
	1895	93	30,607	602,380	632,987
Central Provinces	1896	95	13,527	1,360,602	1,374,129
	1895	117	12,224	1,249,366	1,261,590
Assam	1896	101	6,554	562,142	568,696
	1895	97	5,987	538,951	544,938
Coorg	1896	7	1,245	43,902	45,147
	1895	7	1,343	36,859	38,202
Madras	1896	489	56,625	4,189,762	4,246,387
	1895	498	55,767	3,977,114	4,032,881
Bombay	1896	325	47,090	2,373,637	2,420,727
	1895	317	47,686	2,442,330	2,490,016
Berar	1896	46	4,500	340,134	344,634
	1895	46	4,912	346,443	351,355
TOTAL	1896	2,247	348,544	19,407,069	19,755,613
	1895	2,211	348,334	19,054,777	19,403,111

Bengal.

There was again an increase in the number of charitable dispensaries in Bengal in 1896, and in the patients under treatment in them, as compared with the figures of the previous year. The total number of dispensaries at work during 1896 in Bengal, exclusive of the medical institutions at Calcutta, was 455, an increase of 28 on the number of the preceding year. At these there were 2,684,610 patients under treatment, 47,109 being in-door and 2,637,501 out-door patients, against 45,243 and 2,434,531 respectively in the previous year. This shows a total increase of 204,831, which was attributed partly to the opening of new dispensaries and partly to the increasing popularity of the institutions. These figures, however, fall short of those for the North-Western Provinces, Madras, and the Punjab, though Bengal has more dispensaries than any of the other provinces, except Madras. The Inspector-General remarks: "The annual reports of medical officers "for the year 1896 show that increased interest has been taken in dispensary manage- "ment, and that Managing Committees have very frequently endeavoured to carry out "suggestions for improvement made by civil surgeons and other inspecting officers. In "many cases new and suitable beds, clothing, furniture, with additional comforts and "conveniences have been provided for patients. New surgical equipment and appliances "have been furnished, and the dispensary buildings themselves have been put in good "order."

There was again a satisfactory increase in the number both of women and children. The increase among women, though not so great as in the previous year, amounted to 24,244, the number having risen from 398,994 to 423,238. Of the diseases under treatment at the dispensaries, cholera, dysentery, and malarial fevers were responsible, as usual, for the largest number of cases. From malarial fever the cases fell from 525,300 in 1895 to 506,757, equal to 18 per cent. of the total number of patients; next came dysentery with 64,641 cases, against 59,757 in 1895, and from cholera the number of patients rose from 11,497 to 14,388. Cases of venereal diseases rose from 57,008 to 64,218. Notwithstanding the increase in in-door patients the deaths fell from 5,568 or 123·1 per 1,000 of total treated in 1895 to 5,487 or 116·4 in 1896. Great attention is paid in these institutions to surgery, and during the year 122,643 operations were performed, against 120,084 in 1895, and of these 224 terminated fatally. The more important operations numbered 3,262, of which 2,567 were extractions of the lens.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1896 and the previous year :—

Name of Institutions.	1896.				1895.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	4,485	35,457	39,942	118·6	6,951	58,441	65,392	107·7
Eden Hospital	1,645	8,432	10,077	86·9	—	—	—	—
Ezra Hospital	205	1,611	1,816	14·6	—	—	—	—
Shama Churn Law Eye Hospital	517	13,206	13,723	—	—	—	—	—
Presidency General Hospital	2,836	356	3,192	53·5	3,124	519	3,643	53·4
Campbell Hospital	9,208	21,766	30,974	221·0	9,186	26,303	35,489	245·5
Police Hospital	2,202	—	2,202	13·1	2,982	—	2,982	6·7
Mayo Native Hospital	1,865	32,460	34,325	121·1	2,000	31,431	33,431	93·0
Chandney Hospital	389	45,357	45,746	59·1	367	45,309	45,676	57·2
Park Street Dispensary	—	29,266	29,266	—	—	30,158	30,158	—
Chitpore Dispensary	—	22,466	22,496	—	—	24,908	24,908	—
Sukea's Street Dispensary	—	17,480	17,480	—	—	18,574	18,574	—
Dufferin Victoria Hospital	296	7,374	7,670	6·7	520	8,315	8,835	7·6
Bhawanipur Dispensary	—	5,278	5,278	—	—	11,023	11,023	—
Southern Suburban Hospital	219	7,332	7,551	114·1	—	—	—	—
Total Calcutta Hospitals and Dispensaries	23,867	247,871	271,738	132·8	26,130	254,981	280,111	135·9
Howrah General Hospital	1,780	10,923	12,703	236·5	1,749	11,691	13,440	245·2
Grand Total	25,647	258,794	284,441	140·0	26,879	266,672	293,551	143·2

The figures for 1896 show a decrease of 7,878 in out-door patients, and of 1,232 in in-door patients, which is accounted for by the year being less unhealthy than the previous one. The death-rate for all the hospitals excluding the Eye Hospital was 142 per 1,000 of the number treated, against 143·2 in the previous year. Cholera patients rose from 600 to 1,007, and the fatal cases from 349 to 566. There was a great epidemic of small-pox in the previous year, when 771 cases were admitted to hospital, and 279 died, but in 1896 there were only 57 admissions of which 16 terminated fatally. Dysentery was not so prevalent, and the number of patients fell from 8,383 to 7,778. The number of cases of malarial fever also fell from 59,256 to 48,982. Venereal diseases show an increase of 542 patients, the number treated having risen from 13,674 in the previous year to 14,216. There were 24,067 surgical operations performed, exclusive of 6,340 of which no details were given, and of the total death ensued in 160 cases, against 124.

North-Western Provinces and Oudh.

During 1896 350 hospitals and dispensaries were at work in the North-Western Provinces and Oudh, or ten more than in the previous year. The number of patients who received medical aid was 3,955,359, against 4,017,195 in 1895. There was thus a decrease in 1896 of 61,836, which was "principally due to famine, on account of which the people "flocked to poor-houses and relief works; also to healthiness of the year, as indicated

" specially by the diminution of cases of malarial fever, and to the issue of a circular " which has stopped the practice of giving fresh tickets to those who have lost their " attendance tickets and thus re-entering them as *new* cases in the register." Of the total number 51·48 per cent. were men, 21·42 per cent. were women, and 27·10 per cent. were children, the two latter showing a small increase on the figures of the previous year, which were 20·88 and 26·84, respectively. The in-door patients numbered 62,441 as compared with 61,514 in 1895, and among them there were 3,704 deaths, giving a death-rate of 59·3 per 1,000, against 3,502 or 56·9 in the previous year. Of the diseases for which the patients were treated 580,752 were suffering from malarial fevers, a decrease of 102,384 on the number of 1895 ; cases of cholera rose from 2,743 to 4,190, and cases of diseases of the eye increased from 319,838 to 343,791. From venereal diseases there were 83,765 patients, against 78,640 in the previous year. The progress of surgical work kept pace with the general increase in the number of patients applying for relief. The number of surgical cases rose from 192,582 to 206,299. These included 31,114 major operations, of which 24,463 resulted in cure and 491 were fatal. Of the 31,114 major operations 9,538 were for cataract, of which 83 per cent. were successful, as compared with 10,565 operations and a percentage of success of 84 in 1895.

Punjab. Ten more dispensaries were at work in the Punjab during 1896 than in the previous year, bringing the total number of these institutions up to 267. At these, 3,122,994 patients were under treatment, being a decrease of 137,623 on the number of 1895. The decrease, however, was chiefly among out-patients. The year was much more healthy than the previous one, and this is the main cause of the smaller number ef applicants for advice and treatment. Of the diseases for which patients sought relief there were 870 cases of cholera, being an increase of 849 on 1895. Cases of malarial fever fell from 438,166 to 363,913. Diseases of the eye showed an increase of 24,215 cases, the number treated in 1896 being 380,034, against 355,819. From venereal diseases there were 34,414 cases under treatment, an increase of 578 on the previous year's figures. Among the in-patients there were 2,339 deaths during the year, being in the ratio of 44·2 per 1,000 of the number treated, against a death-rate of 43·3 in 1895. In surgical work operations decreased from 214,655 in 1895 to 193,370. Of these, 181,634 were cured and 309 died. The falling off in the number of operations is accounted for in some measure to the fact " that the year's " figures represent, as far as possible, the number of patients operated on, and not as " heretofore, merely the number of separate surgical measures employed simultaneously, " such for instance as the opening of several small abscesses in one person for the cure of " the same diseased state." There were 4,837 cases of extraction of the lens for cataract, including 141 remaining under treatment from the previous year ; of these 86·7 per cent. resulted in cure.

Burma. The number of dispensaries existing in Burma at the end of 1896 was 96, or three more than in the previous year. At these, 708,489 patients attended, as compared with 632,987 in 1895. In-door patients rose from 30,607 to 30,929, of whom 23,063 were cured, and 1,921 or 60 per 1,000 died, against 2,150 deaths or 90 per 1,000 in the previous year. The total number of Burmans treated was 412,411, equal to 58 per cent. of the total patients. Malarial fevers, as usual, headed the list of maladies under treatment, the number being 126,085, against 112,864 in the previous year. Cases of venereal disease rose from 24,960 in 1895 to 26,198. Surgical work also showed an increase of 466 operations, the number having risen from 14,271 to 14,737. The number of patients cured, after being subject to operation, was 14,012, and 66 died.

Central Provinces. The number of hospitals and dispensaries at work in the Central Provinces during 1896 was 95, or 22 less than in the previous year. The total number of patients rose from 1,261,590 to 1,374,129. The increase extended to both in and out door patients, the former having risen from 12,224 to 13,527, and the latter from 1,249,366 to 1,360,602. Among the in-patients there were 1,851 deaths, or 136·8 per 1,000 of total treated, an increase of 23 per 1,000 on the mortality of 1895. The increase in attendance, it is observed, would no doubt have been greater but for the establishment of poor-houses and relief works on account of the scarcity. These both furnished some medical relief of their own, and also took off a part of the demand on the regular dispensaries, which proceeds to a large extent from persons whose ailments are mainly due to want. As regards the different kinds of diseases treated the statistics do not exhibit many features that call for notice. Malarial fever, ulcers, diarrhœa, and diseases of the eye and skin were responsible, as usual, for the largest number of cases treated.

There were 23,176 surgical operations porformed, against 31,416 in 1895. Of these, 22,174 resulted in cure and 87 in death. In the operations for cataract there has been a considerable increase, viz., from 479 in 1893 and 949 in 1894 to 1,299 in 1895 and 1,508 in 1896.

Assam.

In the province of Assam there were 101 dispensaries open during 1896, or four more than in the previous year. At these, 568,696 patients were under treatment, against 544,938 in 1895. The in-patients numbered 6,554, as compared with 5,987, and of these 3,459 were discharged cured, 546 relieved, 1,139 discharged otherwise, and 993 died, the latter representing 151·5 per 1,000 of the total in-patients, against a ratio of 188·2 in 1895. The increase in the number of patients treated was attributed partly to the opening of new dispensaries and partly to the growing popularity of these institutions. There was again a small increase of 299 among the indigenous population who resorted to the dispensaries as in-door patients, the number having risen from 1,633 to 1,932. The progress made within the past decade in the extension of the system of bringing medical relief to the poor of Assam, by means of dispensaries, may be gathered from the fact that the number of these institutions has increased from 46 to 101, and the total number of patients from 149,051 to 568,696, or by more than 281 per cent. Of the total number of persons who received medical aid, malarial fever, including kala-azar, accounted for 124,878 cases, or nearly a fifth of the total treated; skin diseases 128,829, worms 84,917, dysentery and diarrhœa 29,900, and diseases of the digestive system 22,693. Cholera patients numbered 2,734, against 1,786 in 1895. Of surgical cases there were 13,080, of which 12,393 were cured and 17 were fatal.

Madras.

Exclusive of the hospitals in the Presidency town there were 475 dispensaries working in Madras at the close of 1896, or 11 less than in 1895. The results of the year were again satisfactory. There were 4,042,533 patients under treatment, as compared with 3,839,354 in 1895. There was thus an increase of 203,179. Of the 39,020 in-door patients, 23,752 were returned as having recovered fully under treatment, 8,359 as relieved, and 3,313 as otherwise discharged. The deaths numbered 2,513, representing a ratio of 64·4 per 1,000 of the total in-patients, against 58·9 in the previous year. Diseases of the eye, other diseases of the digestive system, skin diseases, ulcers, malarial fevers, and intestinal worms were the most common diseases under treatment during the year. Cholera existed in an epidemic form throughout the whole Presidency, and 10,776 cases were under treatment in the various hospitals and dispensaries. The surgical operations rose from 141,765 in 1895 to 143,750. Of these, 133,071 were cured and 217 terminated fatally.

The number of medical institutions in Madras town rose from 12 in 1895 to 14 in 1896, and the number of sick treated increased from 193,527 to 203,854. The increase of 10,327 was entirely among out-patients, as the number of in-patients was less by 260. Amongst them, 8,670 cases were recorded to have been cured or perfectly recovered, 4,123 were relieved, 2,966 discharged otherwise, and 923 or 52·4 per 1,000 died, against a rate of mortality in 1894 of 56·6. Of the several diseases for which the patients were treated, malarial fever, diseases of the digestive system and respiratory system were, as usual, the most common. From cholera there were only 63 cases, from dysentery and diarrhœa 6,083, and from venereal diseases 4,174, of which 1,347 were afforded in-door relief. The surgical work performed in 1896 compares favourably with that of the previous year, the operations having increased from 27,715 to 27,903. The results showed that 11,040 cases were cured, 4,359 relieved, and 189 were fatal.

At the Madras Voluntary Venereal Hospital, which is included in the above hospitals in the city, there were 636 patients treated during 1896, an increase of 67 on the number of the previous year. The Superintendent writes: "Patients very rarely seek admission "into hospital in the primary stage of the disease. They usually come in when the "disease is well advanced, and in the enormous majority of cases they leave the hospital "before completely cured. This last fact is due, of course, to the system on which the "hospital is worked being a voluntary one."

Bombay.

Excluding the 11 medical institutions in the city of Bombay, there were 314 hospitals and dispensaries working in the Presidency during 1896. At these, 2,319,346 patients were under treatment, of whom 30,857 were in-door and 2,288,489 out-door patients, against 30,848 and 2,351,221 respectively in 1895. Malarial fevers, as usual, constituted by far the largest number of cases (386,551, or nearly 17 per cent. of the total treated), still there was a decrease of 43,832 when compared with the figures of

the previous year. Next to fever, eye and skin diseases, and worms were the most common ailments. Small-pox and cholera cases were much more numerous, the former having risen from 195 in 1895 to 480, and the latter from 1,813 to 5,879 ; dysentery and diarrhœa cases were also more numerous ; and patients suffering from venereal affections fell from 33,581 in 1895 to 30,482 in 1896. Of the in-door patients 21,758 were cured, 2,784 relieved, 2,943 discharged otherwise, and 2,228 died, the ratio of deaths to total treated being 72 per 1,000, an increase of 15 per 1,000 on the ratio of the preceding year. The numbers of both major and minor operations performed during the year were much larger than in 1895. The total number of patients operated on was 110,994, as compared with 114,193 in 1895, and of these 97,500 were cured and 190 died.

The total number of patients treated at the 11 civil medical institutions working in the town of Bombay during 1896 showed a decrease of 6,566, the figures being 101,381, against 107,947 in the previous year. The in-patients decreased in number from 16,838 to 16,233, and of these 9,773 were cured, 2,789 relieved, 1,042 otherwise discharged, and 1,715 died, the deaths being in the ratio of 106 per 1,000 of the in-patients, against 95 per 1,000 in 1895. As usual, local injuries, malarious fevers, eye diseases, and skin diseases were responsible for the majority of the cases. Venereal diseases contributed 4,799 cases, against 5,251. Cholera cases rose from 2 to 6, and those of dysentery fell from 1,571 to 1,509, but cases of diarrhœa rose from 3,260 to 3,454. The total number of patients operated on was 39,646, and of these 37,555 were cured, 1,816 relieved, 55 discharged otherwise, and 145 died.

Berar. As in 1895 there were 46 medical institutions at work in Berar during 1896. Of these, eight are hospitals wholly maintained by the State. The total number of patients under treatment was 344,634, against 351,355 in 1895. The decrease of 6,721 patients was attributed to a more generally healthy year, as is borne out by the death-rate of the province. In-patients numbered 4,500, of whom 3,647 were cured, and 349 died, which gives a death-rate of 78 per 1,000, as compared with a mortality of 244 or 59 per 1,000 in 1895. Malarial fevers continued to head the list of diseases from which relief was sought, but the cases again fell from 81,683 in 1895 to 71,822 ; nearly a fourth of the total patients were treated under this head ; diseases of the eye and skin came next in order. Cholera cases fell from 3,573 in 1895 to 3,001 ; there was also a small falling off in the number of admissions from bowel affections. There was a decline in surgical work ; the total number of patients operated on being 11,412, against 12,827 in 1895. Of these, 11,000 were cured and 23 died.

The Dufferin Hospital for women and children at Amraoti, which was opened on the 15th February 1895, continued to work satisfactorily. The in door patients during the year numbered 128, and the out-door 5,806, against 96 and 6,215 in the previous year. The operations fell from 270 to 161.

Lunatic Asylums.

Bengal At the five asylums in Bengal (viz., Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,102 lunatics, including 181 fresh admissions and re-admissions, were under treatment in 1896, being a decrease of 5 on the number of the previous year. In the course of the year under notice 61 patients were discharged as cured, and 31 as improved or otherwise, and 90 died. Compared with the figures of 1895, the number discharged was less by 17, while the deaths increased by 15. At the end of the year there were 918 persons still under detention, or 3 less than at the close of 1895. The health of the inmates of the asylum was not so good as in the previous year, the average daily number of sick being 85, against 59 in 1895 ; but the number of admissions into hospital were fewer by 56. The mortality during the year was higher than in any of the preceding 10 years, the number of deaths having risen from 75 to 90 and the death-rate from 81·5 to 98·4 per 1,000 of average strength. Satisfactory progress appears to have been made in the working of dairy farms at the asylums. From Dullunda a profit of Rs. 646 was reported, and the Dacca Asylum, besides affording a sufficient supply of milk to its inmates, realized Rs. 520 from the sale of milk to the public. The dairy farm at Berhampore was opened in the latter part of the year, and is now reported to be working satisfactorily.

In the Bhowanipur Asylum, containing European and Eurasian patients only, the inmates during 1896 numbered 51, against 54 in the previous year. Of this number 32 were under detention at the beginning of the year, and 19 were subsequently

admitted. In the course of the year 6 patients were discharged cured, 1 was dispatched to Europe under the Merchant Shipping Act, 2 were transferred to the care of friends, 1 was despatched to Europe as still insane, and 5 died, leaving 36 under confinement at the close of the year. As regards the health of the patients during the year, there were only 9 admissions to hospital, and 5 deaths. The proportion of deaths to average strength was 150·9 per 1,000, against 106·2 in 1895.

North-Western Provinces and Oudh.

The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the North-Western Provinces and Oudh in 1896 were 1,322, including 277 admissions during the year, against 1,289 in 1895. Before the close of the year 167 patients were discharged, of whom 132 were reported as cured, 35 were made over to friends, and 59 died, leaving 1,096 under treatment at the end of the year. The health of the asylum population was much better than in the preceding year, and the death-rate per 1,000 of average strength fell from 79 to 54·5. Dairy farming was again very successful at Bareilly. This farm was started towards the close of 1890, with a view to reducing the danger of enteric fever and cholera among British troops, by enabling them to obtain a purer supply of dairy produce. Besides giving employment to the inmates of the asylum, it has been of great use to the garrison and Civil Station of Bareilly. Schemes were under consideration for connecting the Benares and Agra Asylums with the municipal water-supply system.

Punjab.

The total number of lunatics in the Lahore and Delhi lunatic asylums in the Punjab during 1896 was 495, including 150 fresh admissions, against 478 in 1895. At the end of the year the number was reduced to 364 by the discharge of 109 patients (50 as cured, 37 made over to friends, and 22 otherwise discharged), and 22 deaths. The year being a fairly healthy one, there were fewer admissions into hospital, and the mortality was much lower in both asylums than in 1895. The total number of hospital cases was 408. In Lahore the cases fell from 492 in 1895 to 367, and the deaths from 40 or 168·0 per 1,000 of daily average strength to 18 or 76·6. Pneumonia was the cause of only 2 deaths in this asylum as compared with 14 in the previous year. In the Delhi Asylum the mortality was the lowest on record, the deaths numbering only 4 or 3·39 per 1,000, against 11 or 98·8 in 1895. Both asylums were again entirely free from cholera in 1896. The question of the construction of a Central Asylum for the province, to contain the patients of both the Lahore and Delhi Asylums, was still under the consideration of the Government.

Burma.

The Rangoon Asylum is the only one in the province of Burma. Until the year 1894 a number of lunatics were, for want of accommodation, confined and treated in the Rangoon central jail. The asylum has since been twice extended, and there is now accommodation for 414 insanes. During 1896 there were 442 patients in the Rangoon Asylum, including 92 fresh admissions, and the total was reduced at the close of the year to 319 by the discharge of 93 patients for different causes, and the death of 30. There was less sickness among them than in 1895, the admissions to hospital having fallen from 129 to 104. No epidemic disease occurred among the patients, and the deaths fell from 36 to 30, of which 10 were from tuberculosis, 3 from dysentery, 2 from chronic diarrhœa, and 5 from mania. Three of the deaths occurred within the first month, and 6 more within the sixth month of residence in the asylum, all of whom were civil lunatics. Of the 414 insanes 195 were criminal lunatics, and among them were 9 deaths as compared with 21 among civil lunatics, the excessive mortality among the latter being attributed to their wretched state of health on admission.

Central Provinces.

In the two asylums of the Central Provinces (Nagpur and Jubbulpore), there were 382 lunatics under treatment during 1896, or one in excess of the previous year, and of these 58 were fresh admissions. In the course of the year 43 patients were discharged as cured or otherwise, and 18 died, leaving 321 still under treatment at the commencement of 1897. The health of the patients was better than in 1895, and the admissions to hospital at Nagpur fell from 126 to 50, but at Jubbulpore they rose from 103 to 109. Cholera and small-pox were absent from both asylums. The chief cause of sickness was, as usual, malarial fever, from which there were 14 admissions at Nagpur, and 41 at Jubbulpore. At both asylums the mortality was lower as compared with the previous year. Of the total 18 deaths, Nagpur recorded 7, being in the ratio of 39·4 per 1,000 of average strength, against 12 or 70·2 in 1895. At Jubbulpore the number of deaths (11) was the same in both years, but the death-rate fell from 74·8 per 1,000 to 71·3. A dairy farm was started in 1895 at Nagpur Asylum with a fair amount of pecuniary success, for the

venture cleared its expenses, and in future, now that the initial expenses have been cleared, it may be expected to yield a considerable profit, besides affording healthy and congenial employment to some of the inmates of the asylum. The healthiness of the patients in this asylum is attributed to the liberal supply of milk from the dairy given to the inmates.

Assam. There is only one lunatic asylum in the province of Assam. This is situated in Tezpur, and the building is reported to be at present large enough for all demands on it. The total number of lunatics under treatment in the asylum during 1896 was 153, being an increase of nine on the number of the previous year. Of these, 42 were fresh admissions. At the close of the year the patients in the asylum were reduced to 126, 18 of the total number having been discharged, 7 died, and two escaped. Although the year was an unhealthy one in the district, there was less sickness in the asylum, and the mortality fell considerably. Of the 153 inmates 82 were admitted to hospital during the year, as compared with 23 in 1895. The number of deaths was the same in both years, and the death-rate was 60·1 per 1,000 of average strength in 1896, against 65·9 in 1895. Four of the deaths were from anæmia, and one each from dysentery, pneumonia, and tetanus.

Madras. At the commencement of 1896 there were 608 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 156 fresh cases were admitted, bringing the total population up to 764, or 50 less than the number in the preceding year. In the course of 1896 there were 134 cases of discharge, and of these 95 were cured. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. The health of the insanes was much better than in the previous year; the daily average sick fell from 123 to 87, and the deaths from 110 or 182·5 per 1,000 of average daily strength to 46 or 77·7. In all three asylums the mortality fell to about half what it was in 1895. There were no epidemics in any of the asylums, and only one imported case of cholera was treated in the Madras Asylum, while in the previous year there were 37 cholera deaths in this asylum. Of the total 46 deaths the Madras Asylum contributed 38, giving a death-rate of 89·6 per 1,000 on an average strength of 424, against a ratio of 213·6 in 1895. The death-rates of the other two asylums, Vizagapatam and Calicut, were 14·9 and 69·2 per 1,000 respectively, against 33·7 and 135·4 in the previous year.

Bombay. The total population of the six lunatic asylums of the Bombay Presidency (Colaba, Ratnagiri, Poona, Dharwar, Ahmedabad, and Sir Cowasji Jehangir, Hyderabad) was 1,006. including 292 fresh admissions, chiefly mendicants and beggars, against 978 in 1895. In the course of the year 192 patients were discharged, 72 of them as cured, and 78 died, leaving 736 under treatment at the close of the year. There was more sickness in the asylums than in 1895, the daily average sick having increased from 45 to 47, and the death-rate rose from 94·7 per 1,000 of average strength to 107·8. Of the 78 deaths, 20 were due to dysentery, 8 to epilepsy, 9 to chronic pneumonic phthisis, and 5 each to pneumonia and Bright's disease. The death-rate was higher in all the asylums, excepting Poona and Hyderabad. In the Colaba Asylum the death-rate rose from 123·7 to 185·6.

Medical Schools.

Bengal. The number of medical schools open in Bengal during 1896–97 was 11. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided—three being schools of homœopathy, one of electro-homœopathy, and two of allopathy. The college is affiliated to the University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the seven unaided schools (two at Dacca and five at Calcutta) follow their own standards for private practice. The total number of pupils attending the various medical schools in the province was 1,910, as compared with 1,854 in the previous year.

The total strength of the Calcutta Medical College at the beginning of the session in 1896–97 was 468 (including 10 women), against 511 in the preceding year. As regards the examinations, 237 candidates (including seven women) were successful out of a total of 445 (including 10 women), the successes being at the rate of 55 per cent., as compared with 57 per cent. in 1895–6. Of the 237 successful candidates, 87 passed the Preliminary Scientific L.M.S. examination, 48 (including three women) passed the first, and 27 (including one woman) the second L.M.S. examinations; 61 (including two women)

passed the Preliminary Scientific M.B. examination; five passed the first and four (including one woman) the second M.B. examinations; nine native dais passed in midwifery from the Eden Hospital, and received certificates of qualification, and 18 pupil nurses also passed as midwives.

The Campbell Medical School had 255 pupils (including 23 women) on its rolls during the session. Of this number 50 males and 6 women passed the final examination for the diploma.

At the Dacca Medical School there were 143 pupils on the rolls (including six women). Twenty-two students of the third-year class passed the diploma examination. No female student has as yet passed the final examination from this school.

The Temple Medical School, Patna, had 132 students (including 4 women) on its rolls. At the diploma examination 52 candidates appeared, and 42 passed, including two women.

At the Cuttack Medical School there were altogether 112 pupils (including five women). At the diploma examination 32 candidates (including one woman) appeared, and 30 passed, including the woman. The other two candidates who failed in one subject only were remanded for three months.

North-Western Provinces and Oudh.

The number of pupils of the various classes of the Agra Medical School who attended the examination at the close of the year 1896–97 was 252 (including 54 women), as compared with 264 at the end of the preceding year. The results of the final examination of male students show that 41 out of 46 candidates passed. All the 10 military students in this class passed, and 26 of the 31 civil students passed. Of the students in Class II., comprising second-year military and third-year civil, private, and Rajputana pupils, all the six military pupils passed the first half professional examination, and 48 out of 58 civil pupils. "On the whole," it is reported, "the average marks obtained by the "civil students were lower than in the previous year, while five failed to obtain "qualifying marks."

As regards women students, the year's working shows that 51 out of the total of 54 were examined, and that 15 passed; seven out of eight in Class I., and eight out of 15 in Class III. The first student in Class I. who gained the Viceroy's silver medal and the Dufferin prize obtained the high total of 765 out of a possible maximum of 900 marks.

Punjab.

The total number of students at the Lahore Medical College and School during 1896–97 was 445, or 24 less than in the previous year. Of these, 238 were in the College Class, and 207 were in the Medical Schools. The result of the year's examinations were on the whole favourable. Two students appeared at the first examination for the M.B. degree, and both passed, and 82 at the first L.M.S. examination, of whom 37 or 45 per cent. passed. In the second L.M.S. examination 9 passed out of 28, and in the second M.B. examination the single candidate passed.

In 1894 a medical school for women, called the North India Medical School for Christian Women, was opened at Ludhiana. The object of the institution is "to provide a thorough "medical training, under fully qualified Christian women, for those Christian women and "girls who wish to prepare themselves for medical mission work." No statistics have yet been received, but at the end of 1896 there were 24 students on the rolls, and they were reported to be making satisfactory progress.

Madras.

The total strength of the Madras Medical College during 1896–97 was 482. Of these, 28 were women students. In the Hospital Assistant Department, consisting of 220 pupils, 73 appeared for examination, of whom 69 passed, 26 being placed in the first class. The results of the several University examinations were again satisfactory, 42 having passed out of 65 candidates entered, against 48 out of 71. In the College Department there were 41 (including one woman) regular students reading for the M.B. and C.M. degree, 34 (including one woman) reading for the L.M.S. degree, and 15 casual students. The percentage of passes to the total examined at the University examination was 64·6, against 67·6 in the previous year.

Government having decided to close the Board Medical School at Nellore, no admissions were made into the school during the year, there were, therefore, only five students who were in their final course of study. At the Prince of Wales' Medical School, Tanjore, there were 35 pupils on the rolls, the highest number on record. At this school candidates are prepared for the Hospital Assistant examination.

Bombay.

The attendance at the Grant Medical College, Bombay, on account of the plague fell from 305 in 1895 to 279 (including 20 women) in 1896. For the first University examination in medicine there were 103 candidates, of whom 35 qualified; and for the second examination in medicine 39 passed out of 89 candidates. For the final examination for the degree of L.M.S there were 36 candidates, and of these only 13 passed, 1 in the first and 12 in the second class. The college sustained a severe loss in the death from plague of Surgeon-Major Manser, whose "teaching," the Principal reports, "was of "an eminently practical character; his experience, too, in Indian diseases was great, and "his opinion was, therefore, of great value."

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The number of students was 203, and of these 35 passed the final examinations.

VII.—SANITATION.

In Calcutta further progress was made in the improvement of bustees, or clusters of Native huts. The supply of filtered water was increased, and the average daily consumption is now equal to 41·42 gallons per head of population for the town proper, and 10·94 gallons for the suburban area. In the course of the year the distribution pipes were extended about 1½ miles, bringing the total length up to 312 miles, and the total number of premises connected had reached 27,184. The supply of unfiltered water slightly decreased, the daily consumption per head of population being equal to 12·47 gallons, as compared with 13·43 gallons in 1895. At the close of the year (1896–97) the total length of sewers was a little over 209¼ miles, and the number of premises connected with them was 29,588, of which 448 connections were made during the year. The new drainage project for the municipality was in hand, but the progress made did not come up to expectations owing to the delay in the acquisition of land, which is said to be unavoidable under the present Act. Some improvement was made during the year in the conservancy of the port of Calcutta. Bengal.

The municipalities of the interior of Bengal spent Rx. 243,008 on sanitation, an increase of Rx. 15,244 on the sum expended in 1895. In addition, the municipalities and district and local boards spent Rx. 126,764 on sanitary works; and a further sum of Rx. 49,413 was contributed by private individuals for the same purpose. The most important works were the completion of the Howrah water supply and the Muzaffarpur drainage schemes, the extension of the Cossipur-Chitpur water supply, additions to the Serampore and Jalpaiguri drainage works, and the construction of drains and the improvement of the water supply at Bhagalpur. The disposal of night-soil continued to receive attention, and in many places improved methods for its disposal were adopted. The Sanitary Commissioner, however, notices that little progress was made during the year in the cultivation of trenching grounds and utilizing refuse as manure. Caste prejudices, he thinks, is largely responsible for this, though he declines to believe that it is so strong that it cannot be overcome. He suggests that municipalities should be required to cultivate their trenching grounds and exhibit the crops on market days, in order to show the superiority of the produce of manured soil. "Object lessons like these," he says, "will probably do more to ovecome caste prejudice than talking to people on "the subject."

The Sanitary Board held three meetings in the course of the year, when, among other important matters, they discussed the Berhampore water-supply project, estimated to cost Rx. 23,883, which the late Maharani Surnamoyèe generously undertook to defray. The work was in course of completion. A scheme for the supply of drinking water to the town of Cuttack, estimated to cost Rx. 22,500, which, however, had to be abandoned owing to the undertaking being beyond the means of the municipality. An alternative scheme for the supply of drinking water to the town of Midnapore was estimated to cost Rx. 25,000. A scheme was brought forward for improving the drainage of the town of Krishnagar, at a cost of Rx. 3,323. Schemes for remodelling the storm water outfall and draining the suburbs of Calcutta, amounting to Rx. 788,709, were approved by the Board. A scheme for supplying pure water to the town of Chittagong, at a cost of Rx. 23,790, was under consideration.

In the North-Western Provinces and Oudh the municipalities expended over 45 per cent. of their income on water supply, drainage, and conservancy. Satisfactory progress was made during the year with the Benares drainage project, which has been under construction for some years past; and in most of the municipalities possessing water-works, house connections were extended, and the quality of the water was good. Early in the year the Meerut water-works were opened, and those at Dehra-Rajpur were completed. During the year the sanitary condition of Naini Tal was investigated by a strong committee appointed by the Local Government, and a report on the subject was submitted in November. Towards the close of the year orders were issued by the Government for reconstituting the Sanitary Board and converting it from a consultative to an executive body, and arranging, so far as practicable, for the employment of an North-Western Provinces and Oudh

efficient sanitary agency to co-operate with it, and for the undertaking of a detailed sanitary survey of each district. The Village Sanitation Act, which had been found useful in certain districts to which it had been tentatively extended, was brought into force throughout the provinces. From lists forwarded to the Government by the Sanitary Board it appears that, between 1889 and 1896, 255 drainage projects have been completed by the Irrigation Department, at a cost of Rx. 117,413, while on the 1st April 1896, 50 works were in progress at an estimated cost of Rx. 43,500, and for the next three years the programme comprises the construction of 104 drainage works, at a cost of Rx. 54,681, these being arranged by districts in order of urgency.

Punjab. In the Punjab the municipal towns spent 21 per cent. of their income on sanitary work. During the year the water-supply schemes of Delhi, Umballa, and Haripur in the Hazara district, were completed, as was also an extension to the waterworks scheme of Simla, at a cost of Rx. 33,121. The water-supply project of Bhiwani was commenced, that of Ludhiana was in progress, and that of Ferozepore under consideration. In Delhi a portion of the drainage scheme was completed, and estimates for the remainder were sanctioned. Drainage projects for Lahore, Mooltan, Gujranwala, Rawalpindi, and Hazro were in progress. A scheme for draining the flooded area of the Karnal district was undertaken, and an estimate was under preparation for extending the Simla sewage scheme. Besides these, several works of public utility were constructed by private individuals, at their own expense, to serve sanitary purposes.

The Sanitary Board met twice during the year, when they considered, among other matters, the drainage scheme of the city and cantonment of Ferozepore; statements drawn up by the Officiating Chief Engineer, describing the sanitary conditions of the municipal towns, and suggesting improvements; and the prevalence of fever in the province, specially in swampy and water-logged areas, and the remedies that might be applied.

Burma. The towns and districts of Burma spent nearly 35 per cent. of their income on sanitary improvements. No important work was undertaken during the year, but municipal committees are reported to have devoted a considerable share of their attention to the subject, and expenditure was incurred on the preliminary experiments and surveys, which are necessary before a mature scheme can be elaborated. In Rangoon experiments were carried out throughout the year, with a view to testing the efficiency of tube wells as a permanent source of water supply; and schemes for improving the water supply were being considered by the municipal committees of Bassein and Akyab.

The work of the Sanitary Board was again restricted to the provision of suitable sanitary maps of the larger towns.

Central Provinces. Sanitary reform in the Central Provinces was interrupted during 1896 by scarcity and subsequent famine. The municipalities expended 16 per cent. of their income on conservancy, drainage, and waterworks. The most important works undertaken or in progress were schemes for supplying water to certain municipalities. The Jubbulpore waterworks were further extended during the year. The Khandwa works were practically completed, progress was being made with those at Wardha and at Harda, and a water-supply scheme on a small scale was under consideration at Hoshangabad. The system of village sanitary inspection books has been introduced in several districts, but little progress was made in filling them in with the information required, owing to the heavy duties falling on civil surgeons in connection with the famine.

The Sanitary Board met in each of the four divisions during the year, when proposals and estimates for schemes of sanitary improvement in the various districts were considered.

Assam. Excluding the towns of Hailakandi, Sunamganj, Karimganj, and Maulvibazar, which have no separate incomes of their own, the municipalities, stations, unions, and towns in Assam spent 46·10 per cent. of their income on sanitation. No extensive sanitary work was undertaken during the year, but the waterworks of Shillong were put into an efficient condition and greatly improved, and the experimental well at Sylhet, with attached reservoir and taps, was completed. The sanitary improvements effected in rural tracts were comparatively unimportant, though some progress was made in the direction

of providing a purer water supply by the construction of masonry wells at some of the larger villages and market places, and the maintenance and repair of existing wells and tanks. No meeting of the Sanitary Board was held during the year.

Madras.

In Madras Presidency the municipal councils allotted 48·1 per cent., and the district boards 8·4 per cent., of their income for sanitary purposes. "It cannot be said," the Sanitary Commissioner states, "that the rate of sanitary progress in municipalities "is such as to render the sanitarian sanguine. Still, progress is apparent, and this "being so, it may be assumed that reforms will be introduced in an ever-increasing "ratio, as one improvement is almost necessarily followed by another, with the "object of securing full results." During the year the water-supply works at Trichinopoly and Dindigul were completed and opened. Similar works were also in progress at Conjeeveram and Kurnool. Village sanitary inspection report books were in use in all unions in 19 out of the 22 districts of the Presidency at the end of the year, the exceptions being Vizagapatam, Anantapur, and Cuddapah.

The Sanitary Board scrutinised plans and estimates for 72 municipal and 87 local fund works, of the aggregate cost of Rx. 27,533. The Sanitary Engineering Department completed surveys for water-supply or drainage for seven municipalities. Six schemes, costing Rx. 198,954, were submitted to the Sanitary Board, and of these the water-supply of Srirangam, Kumbakonam, Gudiyattam, and the construction of filter-beds, and a service reservoir at Cuddapah, were submitted to Government by the Board, and two schemes for the water-supply of Tuticorin and Bellary were under the consideration of the Board. Schemes were also under preparation for the water-supply of Negapatam and Coonoor, and for the drainage of Cuddapah, and revised estimates for five schemes of water-supply were prepared, costing Rx. 173,657. The movement inaugurated under the advice of the Sanitary Commissioner in 1894 to obtain properly qualified Sanitary Inspectors was making satisfactory progress. In 1896, 52 men were granted the necessary certificates, and it is now compulsory for each municipality to entertain one trained man. Twenty-eight councils now employ certificated inspectors, four are employed by District Boards, and provision has been made in the Budget for 1897-98 for five more.

In improving the sanitation of Madras City, several useful improvements were being carried out. The water-supply was extended, and there was an appreciable improvement in the quality. The quantity supplied to the town was nearly one-fourth in excess of that in the previous year. The long-contemplated scheme for the drainage of the city has been taken in hand, the Commissioners having commenced with the drainage of Mylapur. It is, however, observed, "that it will be several years before the drainage scheme is "completed, and until this is done, and the proposed improvements in the water-supply are "effected, Madras cannot be expected to become a healthy town."

Bombay.

In Bombay Presidency the municipalities allotted 45·29 per cent., and the district boards 17·12 per cent., of their income for sanitary purposes. During the year improvements to the waterworks at Karachi and Sukkur were executed; good progress was made in those at Surat and Yeola; while those at Jalgaon and Dhulia were completed. The experimental portion of the sewerage scheme at Ahmedabad was completed, at a total cost of Rx. 38,350, as were also the surface drainage works at Nasik. The Bombay Village Sanitation Act of 1889, under a modified form, has been brought into force in all the districts except Kanara and Upper Sind Frontier.

The Sanitary Board gave advice concerning a large number of projects, including the waterworks of Surat and Rander, Malegaon in Nasik district, Islampur, and Satara, the sewage farm at Ahmedabad, and other sanitary schemes which had been submitted to them.

In Bombay City the Shone system of sewerage at Colaba worked uniformly during the year. In other divisions drainage and sewerage works were in progress, while several new works were commenced. The water-supply of the city from the Tansa, Vehar, and Tulsi lakes continued to be adequate; structural and other improvements in the reservoirs were being carried out.

Berar.

The municipalities of Berar spent 74 per cent. of their income on sanitary improvement. No new works of any great importance were undertaken during the year, but the Kapsi water-supply scheme for Akola was completed, and the Buldana drainage scheme made progress. The District Boards allotted a sum of Rx. 10,683 for sanitary works; of this amount over 77 per cent. were spent during the year, chiefly on water-supply, drainage, and conservancy.

The District Sanitary Boards met once at each of the six headquarter stations. They considered the measures taken by local bodies to give effect to the recommendations of the Provincial Sanitary Commissioner, and recorded their suggestion against each incomplete work. Proposals to legalise a system of village sanitation were circulated throughout the province for the purpose of eliciting native opinion on the subject. About 70 replies were received, all objecting to any legislative interference with the customs of the people in connection with sanitary reform.

W. T. RONSON.

India Office,

November, 1898.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1896.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1896.

(*Surgeon-Major-General J. Cleghorn, M.D.*)

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

European Troops.

Sickness and mortality in 1896.

THE health of the European army of India was better in 1896 than in the preceding year, though invaliding increased somewhat.

European Troops in India.

YEAR.	Strength.	RATIO PER 1,000 OF STRENGTH.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	TOTAL LOSS.
1886–95	677,877	1,457	83	15·16	24	39
1895	71,031	1,462	94	15·26	23	39
1896	70,484	1,387	94	14·84	28	43

The chief causes of admission were venereal diseases and ague. Among the diseases with increased admission-rates were small-pox, influenza, cholera, and hepatitis. On the other hand, the admission-rates from ague, dysentery, diarrhœa, and enteric fever were lessened. Venereal diseases caused 37 per cent. of the total sickness, and ague 17 per cent.

The chief causes of death were enteric fever and hepatic abscess. Among the diseases with increased mortality were cholera, small-pox, and circulatory diseases. On the other hand, the mortality from ague, dysentery, diarrhœa, hepatic abscess, and enteric fever was lessened. Enteric fever caused nearly 43 per cent. of the total deaths, and hepatic abscess 8 per cent.

The chief causes of invaliding were, in order, syphilis and gonorrhœa, debility, tubercle of the lungs, and malarial fevers.

Owing to the system in force for the returns of the army, the following tables must be read with the reservation that the months shown are not really calendar months, but variable periods of from 4 to 5 weeks. However, though the month-headings are not exact, they sufficiently indicate whereabouts in the year or period a maximum or minimum falls. The first table deals with the admission-rate, the second with the constantly sick-rate, and the third with the death-rate, and all are quite or nearly self explanatory. A few remarks may, however, be useful. The first shows that the whole year ratio of 1895 and 1896 were lower than the ratio of the quindecennium ; and that the ratios of all the

months of 1896 after March were lower than their corresponding quindecennial ratios:—

Period.	Admission ratio per 1,000 per annum.												For the Period.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
1880–94	1270·8	1204·6	1272·4	1439·1	1476·6	1479·2	1529·7	1607·2	1744·9	1758·5	1643·9	1365·1	1484·2
1895*	1368·3	1287·3	1375·5	1467·4	1559·5	1547·0	1597·9	1503·2	1476·9	1535·4	1450·8	1363·5	1460·0
1896 ...	1344·0	1294·5	1331·8	1373·1	1360·0	1413·3	1515·8	1452·7	1439·2	1443·6	1401·4	1215·8	1386·7

* Excluding Field Forces.

It also shows that while the maximum monthly ratio for the fifteen-year period was that of October, both 1895 and 1896 had their maximum in July. The next shows that the whole-year constantly sick ratios of 1895 and 1896 were considerably higher than the ratio for the quindecennium, and that every month of 1896 had a higher ratio than the corresponding quindecennial month. The increase of the constantly sick-rate of recent years was attributed on page 16 of the report for 1895 to the increase of enteric fever and venereal affections, diseases which Table IV. shows to occur in large numbers, and to necessitate a long stay in hospital. To these may be added influenza, especially in some of the years from 1890 onwards.

Period.	Constantly sick-rate per 1,000.												For the Period.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
1880–94...	76·3	75·3	69·6	69·4	74·4	76·0	78·3	81·1	84·2	80·8	78·7	74·8	76·6
1895* ...	97·5	91·5	87·0	90·2	93·9	95·7	97·1	97·2	94·2	92·5	93·3	93·6	93·6
1896 ...	98·8	94·9	93·6	90·8	91·7	92·2	95·7	97·7	98·1	92·7	92·8	87·2	93·8

* Excluding Field Forces.

In addition, the above shows that while the maximum month in the fifteen-year period was September, the maximum of both 1895 and 1896 was in January. In 1896 this was due to the prevalence of influenza and pneumonia in the end of 1895 and beginning of 1896; and in 1895 there seems to have been an unusual amount of malarial and enteric fevers at the beginning of the year. The third table shows that the whole-year ratios of 1895 and 1896 were below the ratio of the quindecennium, and that after July all the monthly ratios of 1896 were below the corresponding quindecennial ratios:—

Period.	Death ratio per 1,000 per annum.												For the Period.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
1880–94...	11·52	9·49	9·51	13·68	16·88	19·36	17·73	21·14	21·64	16·85	14·29	12·88	15·46
1895* ...	9·06	8·18	6·36	14·59	21·40	19·95	14·67	18·51	15·44	13·10	11·48	13·66	13·79
1896 ...	14·81	8·45	15·48	20·37	18·60	14·96	19·86	17·77	14·05	11·93	10·24	10·98	14·84

* Excluding Field Forces.

It shows, too, that 1895 and 1896 had their maximum month of mortality earlier in the year than that of the fifteen-year period.

In the following table the ratios of the four commands are placed side by side for comparison. Bengal had the highest mortality from cholera, enteric fever, ague, tubercle of the lungs, dysentery, and hepatic abscess ; the Punjab the highest from remittent fever, heatstroke, and pneumonia, and the lowest from cholera, small-pox, tubercle of the lungs, and dysentery ; Madras the lowest from enteric fever, heatstroke, and pneumonia ; and Bombay the highest from small-pox and respiratory diseases other than pneumonia. The percentage of enteric fever in total deaths was greatest in the Punjab, and the percentage of hepatic abscess in Bengal. The total death-rate of Bengal, which was the highest, was not far from being double that of Madras, which was the lowest. Only the Punjab command was more healthy than in the previous year :—

Ratios of Commands.

	Ratio per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.
I.—Strength	22,457	18,823	13,488	15,716	70,484
II.—Constantly Sick-rate	100·2	83·9	99·0	92·2	93·8
III.—Admission-rate :					
Influenza	16·0	6·7	22·6	1·1	11·5
Cholera...	1·8	·2	·4	1·3	1·0
Small-pox	2·1	1·9	1·4	1·2	1·7
Enteric fever	30·2	25·9	16·8	25·5	25·5
Intermittent fever	229·7	257·8	108·1	342·3	239·0
Remittent fever	14·5	19·4	9·4	10·1	13·9
Simple continued fever	33·0	26·0	48·3	14·7	30·0
Tubercle of the lungs	3·9	3·2	7·6	6·5	5·0
Pneumonia	5·1	7·5	3·3	4·3	5·2
Other respiratory diseases	24·2	30·4	24·5	24·7	26·0
Dysentary	35·3	13·9	35·7	19·5	26·1
Diarrhœa	21·4	23·5	9·7	23·2	20·1
Hepatic abscess	3·2	1·4	1·6	2·2	2·2
,, congestion and inflammation	21·8	12·2	35·4	19·3	21·3
Venereal diseases	582·4	395·0	526·3	537·4	511·6
All Causes	1,435·9	1,282·4	1,336·1	1,484·7	1,386·7
IV.—Death-rate of the Year :					
Cholera...	1·47	·16	·44	1·34	·89
Small-pox	·13	·11	·15	·19	·14
Enteric fever	7·70	6·11	4·23	6·36	6·31
Intermittent fever	·22	—	—	·13	·10
Remittent fever	·45	·69	—	·32	·40
Simple continued fever	—	—	—	—	—
Heatstroke	·85	1·06	·30	·38	·70
Circulatory diseases	.76	·27	·37	·57	·51
Tubercle of the lungs	·80	·43	·52	·76	·64
Pneumonia	·58	1·12	·15	·57	·64
Other respiratory diseases	·04	—	·15	·38	·13
Dysentery	·85	·37	·59	·83	·67
Diarrhœa	·04	—	—	—	·01
Hepatic abscess	2·09	·85	·82	·76	1·22
All Causes	18·70	13·60	9·79	15·14	14·84

The following table gives vital statistics of the European troops in Burma as a whole :—

Period.	Strength.	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths from		
				Cholera.	Other causes.	Total.
1890	4,712	1,743	102	—	20·80	20·80
1891	4,623	1,589	92	2·38	17·74	20·12
1892	4,316	1,491	91	—	14·83	14·83
1893	3,928	1,461	96	·25	12·73	12·98
1894	3,940	1,465	93	·25	9·39	9·64
1895	4,045	1,410	96	·99	8·41	9·39
1896	4,174	1,514	109	·48	6·71	7·19

Burma in 1896 was distinguished by the prevalence of influenza, simple continued fever, and hepatitis.

The following table shows that, judging by the constantly sick-rate, Burma Inland and Gangetic Plain were the most unhealthy for the decennium, and the Hills and the Deccan the most healthy. It also shows that the 1896 constantly sick-rate of every group, except Bengal-Orissa, Western Coast, and Southern India, was higher than its corresponding decennial ratio, and that the rise was greatest in the cases of Central India, Burma Coast, and the Hills. As compared with the decennial ratios, there was increase of cholera mortality in six groups, and of enteric fever mortality in eight :—

—	Ratio per 1,000 of Strength.											
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X	XI.	XII*a*.	XII*b*.	
	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
1886-95 Constantly sick ...	89·0	99·4	92·9	96·0	88·9	83·9	88·0	79·1	81·7	82·2	70·9	88·0	82·6
1886-95 Death—Cholera ...	·21	1·71	·78	4·31	1·14	1·13	1·65	·74	—	·30	·61	·78	1·33
1886-95 Death—Enteric fever	3·02	2·47	3·13	5·98	7·03	5·30	7·00	4·69	2·14	2·79	5·56	4·98	5·28
1895 Constantly sick ...	86·4	102·4	96·9	105·4	94·6	89·2	101·5	97·2	83·3	71·5	92·0	96·1	93·7
1895 Death—Cholera ...	—	1·51	·88	2·12	·14	—	·58	·52	—	—	—	—	·45
1895 Death—Enteric fever	4·04	1·51	6·16	7·36	6·74	8·52	6·94	5·15	2·56	1·32	5·25	4·73	6·72
1896 Constantly sick ...	115·7	110·9	79·6	100·7	92·3	95·1	120·1	89·7	78·2	78·4	89·6	88·5	93·8
1896 Death—Cholera ...	·76	·37	1·22	1·07	·21	—	2·64	1·58	·64	1·12	—	—	·89
1896 Death—Enteric fever	1·53	·37	4·07	11·61	5·21	5·79	8·39	6·01	10·28	5·34	8·20	3·62	6·31

In the following table the vital statistics of the groups for 1896 will be found placed side by side to facilitate comparison. Central India had the highest constantly sick and admission rates ; Gangetic Plain the highest death-rate ; Western Coast the lowest constantly sick and admission rates ; and Southern India the lowest death-rate. Burma Coast had the highest admission-rates from influenza, hepatitis, and the lowest from remittent fever ; Burma Inland the highest from simple continued fever, and the lowest from enteric fever ; Bengal-Orissa the highest from remittent fever, dysentery, and hepatic abscess ; Upper Sub-Himalayan the highest from pneumonia ; Indus Valley the highest from ague ; Central India the highest from cholera, respiratory diseases other than pneumonia, and venereal diseases ; the Deccan the highest from tubercle of the lungs ; Western Coast the lowest from ague, tubercle of the lungs, dysentery, hepatic abscess, hepatitis, and

venereal diseases; Southern India the highest from small-pox, and the lowest from diarrhœa; the Hills the highest from enteric fever, rheumatic fever, and diarrhœa:—

Ratios of Geographical Groups.

	Ratios per 1,000 of the Average Strength.												
	I. Burma Coast and Bay Islands.	II. Burma Inland.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalayan.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XIIa. Hill Stations.	XIIb. Hill Convalescent Depôts and Sanitaria.	India.
I.—Strength	1,310	2,679	2,460	7,492	14,390	4,837	6,440	10,157	1,556	3,561	8,776	3,591	70,484
II.—Constantly Sick-rate of the Year.	115·7	110·9	79·6	100·7	92·3	95·1	120·1	89·7	78·2	78·4	89·6	88·5	93·8
III.—Admission-rate of the Year:													
Influenza	127·5	1·1	—	33·5	12·4	2·7	3·3	8·5	—	1·1	4·1	12·8	11·5
Cholera	·8	·4	1·2	1·9	·3	—	3·0	1·6	—	1·1	—	—	1·0
Small-pox	—	·4	—	4·0	2·6	1·0	3·0	·4	—	4·8	·3	·6	1·7
Enteric fever	13·0	4·5	18·3	40·0	19·8	23·8	30·4	23·1	17·4	16·0	47·2	10·3	25·5
Intermittent fever	105·3	157·1	204·9	183·4	248·7	523·5	376·1	265·1	75·8	80·3	163·9	178·8	239·0
Remittent fever	3·1	6·0	50·4	12·8	16·7	29·2	9·8	7·5	9·6	11·0	7·3	22·0	13·9
Simple continued fever ..	41·2	148·2	6·1	71·4	22·2	35·4	17·9	9·4	81·0	34·5	12·0	5·3	30·0
Rheumatic fever	—	1·1	·4	·3	1·4	1·2	·9	·3	—	1·1	3·1	·8	1·1
Tubercle of the lungs ..	2·3	3·7	3·7	3·1	3·1	2·9	3·6	7·7	·6	2·8	3·8	3·9	5·0
Pneumonia	3·1	3·4	·4	3·6	8·5	8·1	5·4	3·3	1·3	4·5	4·1	3·1	5·2
Other respiratory diseases	33·6	22·4	15·0	20·6	30·7	27·9	38·5	25·4	18·0	16·6	22·8	24·8	26·0
Dysentery	58·0	26·1	66·3	38·0	15·9	15·7	17·4	32·1	9·0	34·0	17·7	22·6	26·1
Diarrhœa	13·7	16·4	30·1	16·9	18·1	21·7	25·5	13·4	23·8	5·6	32·9	29·2	20·1
Hepatic abscess	1·5	1·1	6·5	2·9	1·7	1·4	2·0	2·4	·6	2·0	1·1	3·3	2·2
„ congestion and inflammation.	58·0	53·4	20·7	21·4	13·1	10·8	25·6	23·5	9·0	30·6	15·2	17·0	21·3
Venereal diseases	546·6	547·6	494·7	534·2	487·0	436·4	688·7	547·3	419·7	500·4	478·5	387·9	511·6
All Causes	1,468·7	1,593·5	1,302·4	1,393·6	1,340·7	1,669·2	1,756·4	1,317·3	1,110·5	1,208·9	1,269·1	1,196·6	1,386·7
IV.—Death-rate of the Year:													
Cholera	·76	·37	1·22	1·07	·21	—	2·64	1·58	·64	1·12	—	—	·89
Small-pox	—	—	—	—	·28	—	·47	—	—	·56	·11	—	·14
Enteric fever	1·53	·37	4·07	11·61	5·21	5·79	8·39	6·01	10·28	5·34	8·20	3·62	6·31
Intermittent fever	—	—	1·63	—	—	—	·16	·10	—	—	—	·28	·10
Remittent fever	—	—	1·22	·13	·69	1·03	·16	·10	—	—	·34	·84	·40
Simple continued fever ..	—	—	—	—	—	—	—	—	—	—	—	—	—
Heatstroke	—	·37	·41	1·20	1·18	1·86	1·09	·30	—	—	—	—	·70
Circulatory diseases ..	·76	·37	·81	1·07	·14	·62	·47	·30	1·29	·84	·34	·84	·51
Tubercle of the lungs ..	·76	·37	·41	1·07	·56	·41	·62	·49	1·29	·28	·46	·56	·64
Pneumonia	·76	—	—	·27	1·39	1·24	·93	·69	—	—	·23	·28	·64
Other respiratory diseases	—	—	—	—	—	—	·47	·10	—	·28	·11	·56	·13
Dysentery	2·29	·75	1·63	·53	·42	·41	·47	1·38	1·93	—	·11	1·11	·67
Diarrhœa	—	—	—	—	·07	—	—	—	—	—	—	—	·01
Hepatic Abscess	1·53	·75	3·66	2·14	·76	1·03	·93	1·28	—	1·12	·91	2·51	1·22
All Causes	11·45	5·60	17·07	22·42	13·83	14·47	19·72	14·67	17·99	11·23	12·53	12·53	14·84

The percentage of enteric fever to total admissions in 1896 was greatest in the Hills; of ague in the Indus Valley; of remittent fever, dysentery, and hepatic abscess in Bengal-Orissa; of simple continued fever in Burma Inland; of pneumonia in Upper Sub-Himalayan; of other respiratory diseases in Burma Coast and Upper Sub-Himalayan; and of venereal diseases in the Deccan.

The highest ratios among the large garrisons with a strength of over 1,000 were those of Allahabad, Fyzabad, Lucknow, and Agra. Those of the last two were lower than in the preceding year; that of Fyzabad only slightly higher, while that of Allahabad was more nearly four than three times higher. The cause of the great rise at Allahabad was an increase of enteric fever.

The statistics of individual regiments show that the infantry had the highest admission and constantly sick rates, as in the previous year; the artillery the highest invaliding rate, as in 1895, and the highest death-rate. The 1st battalion, Royal Welsh Fusiliers, at Jhansi, had the highest constantly sick ratio among infantry regiments, and the 1st Norfolk at Allahabad the highest death-rate. The latter regiment suffered severely from enteric fever, to the extent of 93 admissions and 32 deaths.

Principal diseases: Influenza.

Sickness and mortality having been studied in their relation to India, to commands, to geographical groups, to stations, and to regiments, it will be convenient now to discuss the statistics of some of the chief diseases. Influenza, which had been rising in the end of 1895, reached a maximum in January 1896, and after two temporary rises, one in March and the other in September-October, fell again in the last two months of the year. The following shows the increase in 1896 over 1895. It also shows the fluctuations of the disease since 1890, the first epidemic year:—

Period.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Per 1,000 of strength.
1890	—	3	473	1,451	248	69	13	2	3	—	—	1	2,263	33·4
1891	1	—	1	16	77	91	112	29	20	2	2	21	372	5·5
1892	113	53	354	241	57	4	32	8	—	—	—	—	862	12·7
1893	1	—	—	15	4	—	—	—	—	—	—	1	21	·3
1894	7	9	12	70	101	30	7	7	—	2	—	—	245	3·4
1895	14	7	52	156	66	35	17	1	5	13	23	165	554	7·8
1896	262	65	140	30	12	7	3	3	88	128	50	20	808	11·5
Total	398	137	1,032	1,979	565	236	184	50	116	145	75	208	5,125	

The actual maximum of the individual years of the seven occurred in various different months, but over the seven-year period as a whole the greatest number of cases occurred in April and March, and the smallest number in August and November; 85 per cent. of the whole in the first six months of the year, and only 15 per cent. in the last six months. Geographical Groups I., II., V., VI., VII., VIII., IX., XI., XII*a*., and XII*b*., were attacked both in 1895 and 1896; while Groups IV. and X. were spared in both years, as well as in 1894. Twenty-five stations were attacked in 1896 against twenty-three, nine of them suffering only in 1896, sixteen in both years, while some escaped that had been affected in 1895. Among stations, Lucknow, Rangoon, Bareilly, and Secunderabad had the greatest numbers of cases. There were two distinct outbreaks at Rangoon, while at Bareilly the disease was confined to the first three months, and at Lucknow to the last four months of the year. Rangoon had a large number of cases in the preceding year also. The average number of men constantly sick with influenza was 61, against 16 in 1895, and the average duration of a case 28 days against 10. The returns deal, of course, only with those cases which were admitted into hospital, but there were mild cases not admitted. On page 68 is given a table showing the relation year by year of influenza to pneumonia, and of the influenza of the European troops to that of the native troops and to that of the prisoners.

Cholera.

General questions regarding the etiology, spread, and prevention of cholera, and the circumstances attending the most important outbreaks of 1896, are discussed in pp. 89–101 and 143 and 144.

The amount of cholera was greater than in the previous year, but the ratios were lower than those of the decennium, as may be seen in the following table :—

Period.	Admissions.		Deaths.	
	Number.	Per 1,000 of strength.	Number.	Per 1,000 of strength.
1886–95	1,280	1·9	901	1·33
1895	44	·6	32	·45
1896	70	1·0	63	·89

The disease was at its maximum in March ; there was none of it before March or after August ; and Poona with 13 cases, Benares and Jhansi suffered most.

Small-pox.

The admission-rate from small-pox was nearly six times, and the death-rate nearly five times, as great as in 1895. There were 122 cases with 10 deaths, against 19 cases with 2 deaths. The death-rate was also more than one and a half times the decennial ratio of 1882–91. The greatest numbers of cases at individual stations were 17 at Bangalore, 16 at Allahabad, 9 each at Rawalpindi and Umballa, 7 at Meean Meer, and 6 at Meerut. This list of stations itself shows that the disease was widespread ; but it may be stated in addition that each of the four Commands had much increased admission ratios. In Burma Coast, Bengal-Orissa, and Western Coast small-pox was absent, as in the preceding year ; and in the Deccan there was less ; but in all the other groups there was an increase, mostly large.

Fevers.

Ague gave rise to about 17 per cent., an unusually low proportion, of the admissions from all causes. The year 1896 was a very dry one, and naturally it was also comparatively non-malarious :—

Period.	Intermittent Fever.		Remittent Fever.		Simple Continued Fever.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–95	353	·18	9	·54	57	·04
1895	336	·25	13	·30	22	·04
1896	239	·10	14	·40	30	—

The preceding year had also been dry and non-malarious, but not to such a degree as 1896. In 1896 ague ratios were high in Indus Valley, Central India, and Upper Sub-Himalayan, and low in Western Coast and Southern India. And that that is a usual state of things may be seen from the following :—

Period.	Ratio per 1,000 of Strength.												
	I. Burma Coast and Bay Islands.	II. Burma Inland.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalayan.	VII. North-Western Frontier, Indus Valley and North-Western Rajputana.	VIII. South Eastern Rajputana, Central India, and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII*a*. Hill Stations.	XII*b*. Hill Convalescent Depôts and Sanitaria.	India.
1886–95...	194·5	531·2	381·8	216·9	465·5	632·4	496·9	228·0	164·3	119·0	291·0	320·4	352·9
1895 ...	176·9	140·8	339·5	166·5	415·6	952·9	337·9	249·7	72·3	101·3	268·9	421·7	336·0
1896 ...	105·3	157·1	204·9	183·4	248·7	523·5	376·1	265·1	75·8	80·3	163·9	178·8	239·0

Since Upper Burma has become settled and the soldiers less exposed, there has been a great reduction in malarial fever in the Burma Inland group. The most malarious month of 1896 was September, and the least malarious February. At Fort Lahore the water was regularly boiled, attention was paid to clothing, and 5-grain doses of quinine were given daily during October and November.

Though there was no field service in 1896, there was again an increase in remittent fever, as shown above. The principal increase was in Burma Coast, Upper Sub-Himalayan, Indus Valley, and Southern India. None of the medical officers seem to have regarded the disease as of sufficient importance to call for remarks, but at Rangoon and Amritsar it was stated to have been mild in type. All the fatal cases were ascribed to malaria, and the *post-mortem* appearances recorded were compatible with that diagnosis, though in one case there was a small superficial abscess of the liver, and in another there might be some suspicion of septicæmia. Remittent fever was most prevalent in June and in the period June-October.

The rise in simple continued fever was perhaps what might have been expected in a dry hot year; the maximum was in June. Medical officers sometimes note that cases returned as simple continued fever may have been mild cases of enteric fever; and they differ in practice as to where they draw the line between simple continued fever and enteric fever, as well as between simple continued fever and ague. A recent writer has stated his belief that ardent fever may develop into enteric fever, or at least into *an* enteric fever.

On page 26 of the report for 1892 (page 53 of "Report on Sanitary Measures in India in 1892-93," vol. xxvi. [C. 7192]) a hint was dropped as to the possible occurrence of Malta fever in India. Since then the actuality thereof has been positively asserted as regards certain stations, more especially Subathu, on the ground that the blood-serum of some soldiers invalided from those stations was found at Netley to react specifically with the *micrococcus Melitensis*. The subject deserves further investigation, preferably in India itself. By the use of the method of serum diagnosis it is said to have been shown that the *micrococcus Melitensis* is the true cause of Malta fever; that Malta fever occurs in India; that certain cases which had been diagnosed as enteric fever were really cases of Malta fever; that certain cases which had been diagnosed as enteric fever were cases neither of enteric fever nor of Malta fever, but either malarial or of some as yet undifferentiated class; and that the agglutinating and sedimenting power of patients' serum persists for years. If the very promising method of serum diagnosis fulfils all that is hoped and expected of it, a certain measure of the light of certainty will be thrown upon the differentiation of Indian levers.

Enteric fever.

In the matter of enteric fever the differentiation of the bacillus and the treatment of the disease by enteric serum, the diagnosis of the fever by the patient's serum-reaction to a true cultivation of the specific bacillus, preventive inoculation or vaccination, and the question as to how wide may be the dissemination of the enteric bacillus in nature, continue to be the chief topics of interest. Just as when tubercle bacilli gaining access to a blood vessel are carried to all the parts supplied with blood, and produce general tuberculosis, so was the enteric bacillus distributed by the water pipes at Maidstone. A different mode of water-conveyance, its effectiveness doubtless aided by other factors, such as exposure, fatigue, low spirits, fear, &c., is described by a writer in the "Indian Medical Gazette," who says that after the earthquake of the 12th June there was a smart outbreak of enteric fever among the younger residents of the station of Shillong, the cases occurring simultaneously. The earthquake had damaged the waterworks, and people were obliged to have recourse to water from impure sources. "This," he says, "is one more instance "of the dependence of enteric fever on the drinking of impure water, and it further opens "up the question as to the widespread distribution of the typhoid bacillus."

The modern view regarding the value of the chemical and bacteriological examination of water as a guide may be summed up as follows, more or less in the phraseology of the late Sir George Buchanan:—"They can tell us of impurity and risk, but cannot guarantee "purity and safety. Besides utilising the aid of the chemist and the bacteriologist, we "must learn the geological source and history of the water, and must go in search of the "conditions surrounding and affecting the source and storage."

Hankin, who stated that the water of some Indian rivers possessed a bactericidal power against the cholera microbe, finds that the enteric bacillus is not affected by the same water.

Abba, working under certain experimental conditions with Pasteur-Chamberland filter-candles, found that one or two kinds of the water bacteria could grow through the candle in about ten days, while the cholera commas, the enteric bacillus, and the *bacillus coli*,

could not get through. The bacteria which can pass the filter are, he says, such as find in the water an environment favourable to growth as well as to life.

In connexion with the question of water a paper on the liability of total abstainers to enteric fever may be here referred to; and the danger of the spread of infected water through the medium of milk is illustrated by another.

The possibility of air and dust-borne enteric fever is held by some; but Germano has shown by a series of experiments that the enteric bacillus cannot survive thorough drying, or such a degree of drying as would allow it to be carried away by currents of air. But, as he proves, it can not only exist for a long time in moist media, but can also survive under certain circumstances in an apparently dry condition, provided it adheres to articles, or is surrounded by materials, which preserve a certain amount of moisture in themselves, such as linen, articles of clothing, wood, heaps of earth, dust, and fæces-containing dirt. Even in such circumstances most of the bacilli die, but a few survive. These cannot become a danger by getting into the air, because that would require so fine a crumbling that complete dryness, and therefore death of the bacilli, would result. But the danger is that they may get on to the fingers, on to food, on to dishes, and so into the mouths of susceptible men. Just this property of the enteric bacilli to survive a long time in a half dried condition, concludes Germano, must be considered as one of the chief sources of enteric infection. Sinnhuher also found that in pulverised garden earth kept in a moist state cholera and enteric bacilli retained their vitality for several months, perhaps for indefinite periods.

In India, as elsewhere, enteric fever has sometimes been supposed to be conveyed in bread. Arloing, however, points out that while the enteric bacillus dies at 60° C., the temperature of an oven reaches 200° C., and the central part of the bread during baking 110° C. He placed rich cultures of the enteric bacillus in pipettes in the middle of loaves, and then baked the loaves for from 15 minutes to one hour. All were rendered sterile; and he concludes that "one can therefore lay down that, even if bread be prepared with "water containing Eberth's bacillus, the baked bread will be harmless."

Dwouieglazoff in 37 examinations of 15 patients' mouths found the enteric bacillus twice, but not at all in 10 similar examinations of the attendants.

Laveran mentions that in the case of an outbreak in a military depôt in France the enteric bacillus and fragments of tape-worm were found on the leaves used for salad by the non-commissioned officers, who alone were affected, and he specially warns against strawberries as likely carriers of infection. This latter may very likely be one of the modes of conveyance of the disease in the Himalayan hill stations of India.

Ransom in a lecture stated his strong belief in the spread of enteric fever by personal contagion, and he gave several instances occurring in the case of nurses and hospital attendants. He reminded his hearers that the vitality of the bacilli is considerable, and that they may be found not only in the fæces but also in the urine and sputa, and live long outside the body; and that the necessary precautions were prevention of dried excreta reaching the dust of the room or the clothes of the nurse, as well as the careful washing and disinfection of the hands of the latter, and the disinfection of the patient's stools.

Continuing the subject of the spread of enteric fever, the following are some facts regarding Widal's test with mother and fœtus. A child was born when the mother was in the about third week of the disease; it was healthy except for slight transitory jaundice; when the child was about 7 weeks old its blood serum gave a positive reaction, so that "either the agglutinating principle had passed from the mother's into its blood, or, more "probably, it had had enteric fever." A woman suffering from enteric fever at about the fifth month of pregnancy gave the reaction; she recovered; the child was born about four months afterwards; when the child, which was breast-fed, was five weeks old its blood failed to react, while the mother's, tested at the same time, reacted positively. The inoculation of a pregnant guinea-pig lent a weakened reaction to the blood of the fœtus. In a nearly full term fœtus of a mother affected with enteric fever both the enteric bacillus and the staphylococcus were found in the blood, spleen, and liver. Enteric bacilli were found in the blood of a fœtus aborted on the 29th day of its mother's fever. In one case the placental blood gave a positive reaction, while the reaction of the fœtal blood was negative. The occurrence of enteric fever has been reported in a little female child of $13\frac{1}{2}$ months nourished at the breast.

A belief in the spread of enteric fever by sewer gas still lingers, but there is perhaps more ground for fear as to pollution of the soil, and of the floors, &c., of buildings.

As Kanthack says, the virulence of many organisms may also be permanently or temporarily increased, either by changing the composition of the nutrient medium in or on

which they grow, or by passing the organisms through a series of animals (a process which is called passage), especially if the animals be relatively insusceptible. In some cases, however, continued passage will lead to permanent attenuation, an important observation in so far as it helps to throw light on the natural decline of many epidemics, which may cease by virtue of a gradual attenuation brought about by continuous transmission from man to man. Again, Kollman found in the case of guinea-pigs that by means of five rapidly successive inoculations from animal to animal the virulence of the enteric bacillus could be doubled ; and that by two-hourly inoculations the *bacillus coli* had its virulence increased five times. Cultivated on ordinary media these bacilli rapidly began to lose the extra virulence ; and to maintain it an occasional passage through animals was found necessary. Even, therefore, if it be confirmed that the enteric bacillus is widespread in nature, efforts against contamination by excreta must not on that account be relaxed ; for not only do these excreta contain the bacillus, but its virulence therein may be greater than in outside nature, and its virulence may be liable to still further increase by passage through another human body.

It is not known upon what statistics is based the assertion that natives of India when they emigrate to other countries suffer more severely from enteric fever than in their own country, and that the disease has been observed among native troops sent to Hong Kong, North China, Singapore. The Army Medical Reports for the six years 1890 to 1895 show no deaths from enteric fever among the Asiatic troops of China and the Straits Settlements, and no mention is made of admissions. And the Abstracts given in the same reports indicate that the European troops stationed there suffer in less proportion than those in India. See also the Report of the Sanitary Commissioner with the Government of India for 1895, paragraph 17, pages 36 and 37. The records of the Perak Expedition also make no mention of the disease.

It has been stated that British troops have suffered from enteric fever on virgin soil uncontaminated by man, and the remarks made by the medical officer of Quetta and quoted in paragraph 15 may, in this connexion, also be referred to ; but before accepting as an explanation of this the at present not completely proved saprophytic presence of the enteric bacillus in nature, the somewhat difficult task of proving the impossibility of previous human contamination would have to be undertaken.

Several fresh cases of enteric fever without intestinal lesions have been placed on record, and that the disease was really enteric fever was proved in some of them by the discovery of the bacillus in the spleen or bile. Very little work seems to have been done in India in the way of cultivation of the genuine bacillus from the spleen, though this is important both for the diagnosis of the individual case and for the preservation of a standard for laboratory use.

With regard to the occurrence of the bacillus in the urine some additional information has been published. Blumer in the examination of 10 cases of pyuria found the *bacillus coli* in 7, once along with the enteric bacillus ; and the enteric bacillus twice, once with the colon bacillus ; and he remarks that many of the results of the older investigators were wrong, because they mistook the *bacillus coli* for the enteric bacillus. Horton Smith made 61 observations on 7 cases. In 3 cases the urine contained enteric bacilli at some period of the disease, sometimes in enormous quantities. They first appeared in the third week or later. In one case they persisted in the urine for 22 days after the temperature had come down for good. He concludes, firstly, that the examination of the urine is not of much use for diagnostic purposes, because of the late appearance of the bacillus in that excretion, and, secondly, that the urine may sometimes be a serious source of infection.

Kuhnau reports that from the blood taken in a droplet from the finger tip he did not once succeed in isolating the bacillus ; but in blood taken direct from a vein, and used in quantities of 5·10 cc., he found it in 11 out of 41 cases. Sanarelli, as was mentioned in a former report, considers enteric fever to be primarily a blood disease, and he has lately likened it to yellow fever, insomuch as both are blood diseases, and both result in a hæmatogenous enteritis.

In this present and in former reports reference has been made to cases in which enteric fever and dysentery appeared to co-exist or to be mistaken one for another. On this point the Davidsons say :—

"Enteric fever and dysentery may declare themselves simultaneously in the same patient, "and this double infection has been observed occasionally to occur in an epidemic form . . . . . "As the disease advances the dysenteric symptoms yield, sometimes suddenly, to those of "typhoid fever."

The preventive measures usually proposed may be divided into such as are to kill or weaken the bacillus and such as are to strengthen the human being against it. The general aim of all measures of the first class may be shortly stated as cleanliness. But it may be doubted whether "universal public and private cleanliness" is attainable, and whether, if it were attained, enteric fever would be found to have been eradicated.

There is no doubt that for the disposal of excreta cremation is the most thorough and the surest plan, and it is practically convenient to mix the excreta with sawdust before incineration. But a very promising method is that recently described by Sinnhuher, who found that :—

"In pulverised garden soil, kept in a moderately moist state, cholera and enteric bacilli retained "their vitality for several months, perhaps for indefinite periods ; but they were speedily destroyed "by the addition of small proportions of quicklime thoroughly incorporated with the earth. "With 4 per cent. they perished in 4 hours, with 6 per cent. in less than an hour, and with "8 per cent. within 15 minutes. If kept fairly dry, the mixture lost its activity very slowly, not, "in fact, until the lapse of many weeks or months, while it was fully as efficient a deodoriser "as the pure earth. He therefore recommends as the best material for dry-earth closets a mixture "of 10 per cent. of quicklime with dry garden mould, stored under cover from the rain and "well worked together, as calculated to act as a disinfectant or germicide, as well as to render "excreta inoffensive to the smell without any deterioration of their value as a manure."

It is mentioned in paragraph 15 that great use has been made in India during 1896 of boiling, and of the addition of potassium permanganate alum, &c., for the purification of drinking water. Alum is said, however, to be powerless against the enteric bacillus.

The provision of better sources of supply and the use of the Pasteur-Chamberland filter are said to have greatly reduced the morbidity and mortality from enteric fever in the French army ; in 1886 the number of deaths was 964, in 1887 the reforms just mentioned were introduced, and the number of deaths has gradually sunk to 441 in 1896. French writers also point out the necessity for constant attention to the cleanliness of the floors and the wood-work of buildings, especially of those in which cases of enteric fever have occurred.

Many medical officers lay stress on the influence of youth and recent arrival, and some call attention to the increase of enteric fever in a station following the arrival of fresh drafts from England. Some nine or ten men were supposed to have contracted the disease on board ship, at Bombay, or on the way from Bombay to the up country station. Again, medical officers frequently noted, especially in the case of hill stations, that the disease must have been contracted before arrival, either from impurities encountered on the march, or from a cause existing in the previous station ; so that the station where the disease was treated was not always the station in which it was contracted. Some patients acknowledged having used foul or doubtful water in the jungle, on the rifle range, or when marching from the plains to the hills. A complaint was recorded of the dirtiness of camps on the march from the plains to the hills, and of the distance of the good water from a camp, and the nearness of bad water to it. At Bareilly and Nowshera it was noticed that men at the rifle range, or on signalling or field training, that is, men employed outside of barracks, were peculiarly liable to attack, whether from fatigue and exposure, or from being more likely to have recourse to the drinking of dirty water. The water supply was considered liable to contamination at Kasauli, Dagshai, Meean Meer, Ahmednagar, Meiktila, Shwebo, and Bernardmyo. The danger of a double water-supply, one for drinking and one for other purposes, is noted in the reports from Calcutta, Ranikhet, Madras, Bangalore, Wellington, Rangoon, Port Blair, Thayetmyo, Nasirabad, and Taragarh. In some cases there remained the danger of the supply by lazy servants of water from forbidden sources. There was a general feeling among medical officers that mussacks were dangerous, and their use was avoided as much as possible, or they were more or less systematically disinfected. But in two cases it was found that drinking water, after being boiled and cooled, was being distributed in, apparently non-disinfected, mussacks. In some cases it appears that dislike of boiled water or of water treated with permanganate of potash was the cause of men resorting to forbidden sources. At Hyderabad the intake of the water supply from the river was considered to be dangerously placed. The use of dip wells, the fouling of well-ropes by bullock droppings, the non-cleansing of water-pipes that had been lying about before they were laid, were alluded to

as sources of danger. At Cannanore and Mallapuram some of the cases were attributed to the drinking of bad water while on field service against the Moplahs. The combined result of five stations was that 46 cases occurred among total abstainers, and 129 in non-abstainers, or 26 and 74 per cent. respectively. But, as their average annual strengths cannot be obtained, no conclusion can be drawn as to the relative liability of those two classes. As usual, some medical officers point out the comparative immunity of women and children, and use it as an argument against the probability of the disease having been carried by the water or milk supplies. In a circular memorandum, dated Simla, the 12th May 1896, orders were issued by the Principal Medical Officer, Her Majesty's Forces in India, for the abolition of the Macnamara filters, and authorising the necessary expenditure for the use, according to circumstances, of alum, permanganate of potash, or boiling. The extracts given below will show how these instructions have been carried out, and with what results. In many cases, also noticed more fully below, the specific microbe was reported to have been discovered in the water or other article. When three officers of a mess at Meerut were attacked, no enteric microbe was found in their drinking water, but investigation showed that their milk was being supplied from the bazar. The medical officer at Dalhousie urges that, with all the modern minute attention to sanitary detail, there has not been any great practical result in the diminution of enteric fever in India; and, like many other medical officers, he considers the reason of this to be that the men contract enteric fever out of barracks, in the bazars. In support of the contention that enteric fever is mostly contracted in the bazars and especially in the brothels, the medical officers at Fort Allahabad, Meerut, and Nasirabad point out that it was the bachelors who were attacked, and that the married families escaped. In some cases it was noted that men admitted with venereal disease were apt to develop enteric fever, and that placing the bazar out of bounds effected a diminution of enteric fever; but at Nasirabad placing the bazar out of bounds is said to have done no good. The danger in the careless and dirty habits of the native cooks is insisted on by several medical officers, and two of them suggest that the soldiers should be made to cook for themselves, as in England. In some stations measures have been taken to prevent infection-carrying flies having access to food or food-materials. One case was supposed to have been contracted in hospital from eating of food smuggled in by the sweeper who handled the excreta of the enteric fever patients. At Peshawar some cases were attributed to the eating of dirty water cresses. Bernardmyo is said never yet to have *originated* a case of enteric fever;* and the comparative immunity of Belgam is explained by the barracks standing on high ground, and by the water supply being above the reach of contamination. In the case of other stations where enteric fever was absent, rare, or less, the only explanations offered are the possession of a good water supply, and the taking of pains to guard and disinfect the water and milk. Incineration of the enteric stools is reported to have been practised at Chakrata, Peshawar (from October), and Murree. Out of the 1,795 cases of enteric fever which occurred throughout the army of India in 1896, over 34 (the number in some cases being given only as "several") are noticed as having declared themselves among patients in hospital or among attendants. Out of these over 14 were in hospital for venereal diseases, 13 were in hospital for other diseases, and 7 were attendants on enteric fever cases. A second attack of enteric fever was the lot of a man at Bangalore, and a fatal second attack of a man at Dagshai. In a fatal case at Dum-Dum there was a single abscess of the liver, and in a fatal case at Lucknow there was multiple abscess formation.

Medical officers have reported on outbreaks in the case of which the drinking water was suspected, or was said to contain the enteric bacillus; of the measures considered to have been effectual in preventing or checking the disease; and, especially, of the results obtained by boiling the drinking water, or by adding to it potassium permanganate or other chemicals. The instructions issued for the general adoption of such measures have been mentioned above; and, as far as can be judged, they seem to have been carried out with some thoroughness. It is to be hoped, however, that future results will be more striking than those of 1896. Not only are the reports of medical officers somewhat disappointing, but the reduction in the admission-rate of India for enteric fever was only 0·8 per 1,000 strength, 75 cases fewer. And no difference in the carrying out of the prophylaxis, such as earlier beginning or greater care, can be made out from the reports as a reason why the Punjab command should have had a great reduction, the Bombay

* There were 10 admissions in the three years 1889-91.

and Madras commands a greater increase, the Bengal command the slightest possible decrease.

Commands.	Year.	Enteric Fever.		
		Admissions.	Ratio per 1,000 of strength.	Difference.
Bengal	1895	674	30·3	− 0·1
	1896	679	30·2	
Punjab	1895	770	39·0	− 13·1
	1896	488	25·9	
Madras	1895	171	12·7	+ 4·1
	1896	227	16·8	
Bombay	1895	255	16·3	+ 9·2
	1896	401	25·5	
India	1895	1,870	26·3	− 0·8
	1896	1,795	25·5	

Enteric Fever in 1896.—There was a decrease of both morbidity and mortality from enteric fever in 1896. As compared with the corresponding ratios of 1895, the admission and death ratios fell respectively by 0·8 and 0·41 per 1,000 of strength. There were 1,795 admissions and 445 deaths, against 1,870 and 477 in 1895. The average number of men constantly sick from enteric fever was 260, and the average duration of a case was 53 days. The total loss of service due to disease was about 95,109 days.

Fever Mortality.—The following table shows an increase in total fever mortality, which may be ascribed to the greater youthfulness and less average length of service of the soldiers of to-day :—

	1870–79.			1881–90.†			1895.			1896.		
	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.
Army of India	2·03	1·42	3·45	3·79	·70	4·49	6·72	·59	7·31	6·31	·50	6·81

* Intermittent, remittent, and simple continued fevers.

† Excluding troops on active service in Burma during 1885 to 1887.

It shows in the years 1895 and 1896, as compared with the decennia, an increase of mortality from enteric fever, accompanied by a decrease in mortality from the other fevers, which is probably partly due to increased susceptibility to enteric fever on the part of the army from youth and recent arrival, and partly to the increasing frequency with which the diagnosis of enteric fever has been made.

The following table shows enteric fever in the geographical groups in the decennium 1886–95 and in the last two years :—

Admissions per 1,000.

Period.	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.
1886–95 ...	5·7	5·5	7·7	27·7	25·4	15·6	23·9	17·0	5·8	12·1	25·1	13·9
1895	8·9	4·9	11·0	37·8	25·5	27·8	22·8	21·7	9·6	10·3	27·0	19·5
1896	13·0	4·5	18·3	40·0	19·8	23·8	30·4	23·1	17·4	16·0	47·2	10·3

It shows that Groups V., VI., VIII., and XII*a*. especially, are apt to have high ratios of admission from enteric fever, and Groups I., II., IV., and X. low ratios. It also shows at a glance how the groups compare with each other in 1896, and how 1896 compares with 1895 or with the decennium. Group XII*a*. had the highest ratio of 1896, and Group V. the next highest, and in the same groups also the percentage of enteric fever in total admissions was greatest.

The distribution of enteric fever throughout the year by stations and months may be studied in Table VIII. But the following shows those garrisons which had an average strength of over 1,000 in 1896, with the decennial ratios for reference :—

Stations.	1896.		Decennium, 1882–91.	
	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
Allahabad*	87·2	27·20	19·3	5·17
Ranikhet	72·1	10·58	32·6	5·01
Quetta	60·5	9·50	14·0	3·67
Peshawar	45·4	10·72	10·4	4·33
Agra	44·3	12·40	13·9	4·46
Mhow	39·3	5·05	19·2	5·31
Fyzabad	38·9	12·96	22·0	3·89
Meerut	33·4	7·49	15·9	4·93
Bareilly	32·6	9·21	34·2	8·67
Secunderabad ...	32·6	6·12	19·4	5·40
Umballa	24·2	6·92	10·6	2·49
Bangalore	24·1	8·20	18·1	3·66
Lucknow	22·8	8·41	32·7	5·62
Poona	16·9	5·81	10·5	3·58
Rangoon	13·7	1·71	2·6	1·80
Rawalpindi	12·9	5·36	19·9	5·34
Sialkot...	11·6	1·45	32·1	8·13
Wellington	11·4	1·91	5·7	1·95
Fort William	9·5	3·81	3·7	2·21
Kurrachee	8·1	·90	22·4	4·00
Mooltan	7·6	3·81	14·1	4·07
Belgam	6·9	·86	2·9	1·19
Ferozepore	6·5	1·85	11·8	3·85
Aden	3·9	1·95	2·0	1·25
Fort Dufferin ...	2·9	·97	8·1†	3·10†
Colaba	1·7	1·65	4·6	1·59

* Including Fort Allahabad.
† Four Years.

The high position occupied by the decennial admission ratios of Bareilly, Lucknow, Ranikhet, and Sialkot will be observed, and the low position of the ratios of Aden, Calcutta, Bombay, Belgam, and Rangoon.

As certain hill stations have attracted attention of late years by the prevalence in them of enteric fever, and as there is a common belief that enteric fever tends to increase with length of occupation, the following table for hill stations is given, showing death ratios from the earliest year that enteric fever was separately shown in the tables of the Sanitary Commissioner with the Government of India:—

YEARS.	Ranikhet.	Chaubuttia.	Chakrata.	Dagshai.	Solon.	Subathu.	Jutogh.	Cherat.	Murree Hills.
1871 ...	—	—	—	—	—	1·30	—	16·50	—
1872 ...	8·35	—	—	1·24	—	2·51	—	12·66	3·34
1873 ...	1·60	—	—	—	—	2·64	—	2·95	—
1874 ...	2·51	—	—	—	—	—	—	—	1·33
1875 ...	·99	—	—	1·20	—	1·96	—	4·56	—
1876 ...	·77	—	—	2·16	—	2·36	—	9·48	—
1877 ...	·85	—	1·42	3·25	—	6·60	—	2·48	—
1878 ...	2·35	—	—	11·22	—	17·72	—	3·01	3·57
1879 ...	—	—	3·38	1·97	—	11·27	—	10·14	5·30
1880 ...	7·80	—	—	8·52	—	6·19	—	4·85	4·74
1881 ...	3·00	—	1·40	—	9·43	2·51	—	8·33	1·32
1882 ...	1·66	—	—	1·41	4·76	—	4·74	9·98	4·75
1883 ...	—	—	—	1·34	—	5·80	8·51	5·16	—
1884 ...	—	—	—	—	—	—	—	9·17	—
1885 ...	1·68	7·55	—	4·29	5·41	18·58	—	16·43	2·85
1886 ...	5·36	18·94	1·13	13·46	—	2·45	—	13·89	1·75
1887 ...	5·49	8·65	4·14	2·46	4·02	4·11	4·44	22·35	4·40
1888 ...	9·05	8·38	3·35	1·16	4·81	17·43	11·19	1·87	1·87
1889 ...	3·05	—	12·64	2·45	—	12·63	3·72	1·66	2·33
1890 ...	13·36	16·56	16·15	1·28	—	17·54	—	1·82	2·47
1891 ...	5·46	—	5·28	1·22	8·58	—	7·38	31·12	7·91
1892 ...	5·55	—	11·08	15·04	9·22	11·96	7·94	3·28	1·49
1893 ...	2·05	3·19	3·01	10·53	18·18	8·21	4·55	27·43	5·59
1894 ...	2·96	3·52	1·00	24·10	8·89	12·88	4·29	19·82	5·80
1895 ...	2·94	12·86	15·69	2·52	8·40	3·84	8·73	9·85	2·40
1896 ...	10·58	—	1·10	14·01	4·78	33·48	8·51	10·12	1·76

In the case of most of those stations bad years have occurred at more or less irregular intervals; but for some time past, in the case of Dagshai, Subathu, and Cherat, the bad years have been very close together. Special investigations have been made into the sanitary conditions of those stations, and generally suspicion has been thrown upon the water supply.

With regard to the relation of mortality from enteric fever to age and length of residence in India, the results confirm those of former years. The ratio of mortality from enteric fever per 1,000 of strength was greatest in the age-period 20–24, and the relative liability of the same period was 46 per cent., that is, the highest; in the same age-period the total number of deaths from enteric fever was 342, and out of a hundred deaths from all causes 57 were from enteric fever; lastly, out of the total number that died at all ages from enteric fever 78 per cent. were between 20 and 24 years of age. Again, the ratio of mortality from enteric fever per 1,000 of strength was highest in the first year of residence, and the liability for the same period was 36 per cent., that is, the highest; in the first year the total number of deaths was 160, and out of 100 deaths 69 were from enteric fever; lastly, out of the total number that died at all periods of residence from enteric fever 36 per cent. were in the first year of Indian residence.

As regards the relations of *admission* from enteric fever to age and length of residence in India, the age-period 20-24 included 53 per cent. of the total strength of the army, and in the same period the liability to fall sick of enteric fever was greatest, 42 per cent. In the succeeding periods the liability gradually declined. The greatest liability to get enteric fever was in the first year of Indian residence, and that thereafter the liability suddenly declined. Since arrivals have increased, and since the percentage in the army of men under 25 years of age and of men with less than five years Indian residence has been gradually mounting, the admission ratio from enteric fever has also been rising. The greater has become the supply of susceptible material, the more the disease has prevailed.

The monthly incidence of enteric fever may be studied in Table VIII. In the period 1886–95 as a whole the chief enteric fever season, though the disease occurred in all months, was the six months April–September, with one maximum in May and another in August.

Year.*	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000.
1886–95...	518	418	689	1,427	1,795	1,365	1,441	1,718	1,400	923	745	879	13,318	19·6†
1896 ...	65	75	202	214	160	152	175	214	179	90	92	177	1,795	25·5

* The warning given in paragraph 3 as to the months not being calendar months applies here also.
† Including men on Field Service.

In 1896 the greatest prevalence of enteric fever was in March, April, and August; of simple continued fever in June; and of remittent fever in June and July. Of the larger groups, Gangetic Plain had its maximum in March, Indus Valley in June, the Deccan and the Hills in August, Central India in September, Upper Sub-Himalayan in December.

Respiratory diseases.

Respiratory diseases caused less sickness, but greater mortality, than in the preceding years :—

Of the commands the Punjab had, as usual, the highest admission-rate. As to groups, the greatest prevalence was not, as usual, in the Indus Valley, but in Group VIII., Ahmedabad and Nasirabad having had particularly high ratios. The medical officer at Nasirabad says that respiratory diseases are attributable in many cases to the carelessness of the men in coming into the bungalows very hot and sitting behind wet tatties. He adds that the changes of temperature at this station are sometimes very sudden, and so apt to cause bronchial affections.

Probably in connexion with the prevalence of influenza, the admission-rate from pneumonia rose to 5·2 from 4·4, and the death-rate also increased. Upper Sub-Himalayan and Indus Valley were, as usual, the two groups in which pneumonia was most prevalent, but in 1896 the former had a higher ratio than the latter, which is uncommon. Bareilly and Meean Meer had the highest ratios in the Upper Sub-Himalayan group. In the same two groups the percentage of pneumonia to total admissions was also greatest. On page 68 will be found a table showing the relation of pneumonia to influenza year by year, and also of the pneumonia of European troops to that of native troops and prisoners. Most cases occurred in the cold weather, and especially in January, February, and March; January and February having been the minimum months for dysentery, and January and March the maximum months for influenza. The stations with the greatest number of deaths were, in order, Rawalpindi, Peshawar, and Umballa; and their ratios stood in the same order. The medical officer at Rawalpindi says that the pneumonia was very severe and rapidly fatal in the winter months, when the cold was very intense and penetrating; and the medical officer at Peshawar that nearly all the cases occurred in January and the early part of February, when the disease was prevalent and severe among the native population.

The number of European soldiers constantly sick from pneumonia was about 35, and the average duration of a case 35 days against 27. There were no deaths from pneumonia among the troops marching.

Dysentery and diarrhœa.

The admission and death rates from dysentery and diarrhœa fell considerably. This is presumably due to the absence of field service, as well as to the dry and non-malarious character of the year.

Period.	Dysentery.		Diarrhœa.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–95	30	·73	32	·06
1895	35	1·04	24	·07
1896	26	·67	20	·01

Dysentery was most prevalent in the Madras command and in the Bengal-Orissa group. The same command and group had the highest percentage of dysentery in total cases, as may be seen in the Tables on pages 45 and 47. It is usual for that geographical group to have a high dysentery ratio. Dysentery was most prevalent in September, July, and December, and least so in January and February; of the stations, Secunderabad had the most cases; and Poonamallee Depôt, Pachmarhi Sanitarium, and Barrackpore had the highest ratios.

At the end of a long and careful paper on what is known of the causation of dysentery, Janowski of Warsaw thus sums up:—

"Dysentery is etiologically not a single disease, and is apparently not caused by the action of a "single parasite, but by the combined action of several varieties. From the data offered by the "literature of the subject up to date one may conclude that the cause of dysentery is some association "of bacteria. But one of its forms differs clinically and anatomically from the others: the so-called "tropical dysentery is apparently produced by the association of a certain species of amœba with "bacteria."

Kartulis writes also on the same subject.

In India R. Ross has found amœbæ in some cases both acute and chronic. It seems probable that acute dysentery proper and chronic dysentery in continuation of an acute attack may be of amœbic origin; whereas some of the milder forms, whether acute or chronic, which are more of the nature of intestinal catarrh with follicular inflammation and ulceration, may be caused by bacteria. The presence in the intestine of a very virulent form of the *bacillus coli*, which has been named the *bacillus coli dysentericus*, and many other points relating to the causation of dysentery, have been noticed by recent writers.

Hepatitis and absces of the liver.

Though the admission-rate from hepatitis (including abscess of the liver) rose from 19 to 23 per 1,000 of average strength, the rise was confined to the milder forms, and the death-rate fell from 1·45 to 1·25 per 1,000.

Venereal disease.

From venereal disease the admission-rate for India was 511·6, against 522·3 in the previous year. There were 3,162·43, against 3,164·84, men constantly sick in hospital from venereal disease, equivalent to over three regiments. The average stay of a case of venereal disease in hospital was 32·10 days, against 31·49, and the total loss of service was about 1,157,449 days, against about 1,555,167, men on field service being excluded from the calculation. There were 14 deaths and 479 invalidings directly due to venereal disease, against 15 and 353. The highest ratios were at Ahmedabad, Nowgong, and Shahjahanpur; and the greatest increase of ratio, increases of more than 150 per thousand of strength, were at Shahjahanpur and Saugor in the Bengal command; at Subathu in the Punjab command; at Bhamo and Madras in the Madras command; and at Taragarh (strength under 100), Ahmedabad, Nasirabad, Neemuch, Hyderabad, Sitabaldi (strength under 100), Deolali, and Purandhur in the Bombay command. The total venereal ratios of the commands may be compared in the Table on page 45: as in the previous year, the Bengal command had the highest ratio, and the Punjab the lowest. Only in the Bombay command was there an increase of venereal disease. The chief decrease was in the Punjab, and the decrease in the Bengal command was not much less, while the decrease in Madras was comparatively slight. In 46 stations, against 34, the admission-rate from secondary syphilis was over 100 per 1,000 of strength, the highest ratios being those of Poonamallee Depôt, as in 1895, Taragarh (strength under 100), Purandhur, Khandalla Depôt (strength under 100), as in 1895, Deolali Depôt, Ahmedabad, Chaubuttia, as in 1895; and in 22 other stations, against 28, it was over 75 per 1,000. In 1896 the Bengal command had the highest ratio for primary syphilis *plus* ulcer of the penis, and for gonorrhœa; and the Madras command, as usual, the highest ratio for secondary syphilis. For India the ratio of primary syphilis *plus* ulcer of the penis diminished by 12·6, and the ratio of gonorrhœa by 11·0, while the ratio for secondary syphilis increased by 12·8 per 1,000 of strength, the net result being a decrease in total venereal disease, as already mentioned.

In the Bengal command the Rohilkhand district had the highest ratio for syphilis, and the Bandelkhand district the highest for gonorrhœa; while in the Madras command the Madras district had the highest ratio for secondary syphilis.

At Calcutta, Fyzabad, Cawnpore, Chaubuttia, Cherat, Poonamallee, and Belgam the treatment of men as out-patients by hypodermic injection or otherwise appears to have restricted the number admitted and constantly sick. Increase of one or more forms of venereal disease at Meerut, Satara, Purandhur, Mount Abu, and Aden was said to have been largely due to the arrival of men who had contracted the disease elsewhere. Increase at Kurrachee was ascribed to the greater vigour of the men from the diminution of malaria

in 1896. Virulent disease is said to have been caused at Kuldunnah by a number of diseased women who followed the troops up from the plains and settled near the barracks. One reason for the prevalence of the disease at Pallavaram is said to be that the men have little to do, and can easily take a run into Madras City. The decrease at Poona was credited to the fact of the bazars having been placed out of bounds from April to September on account first of small-pox and then of cholera.

To show that the venereal ratios do not err on the side of excess, it may be mentioned, besides what has already been stated regarding out-patient treatment, that the medical officers of Lucknow, Fyzabad, Fatehgarh, Bareilly, Jhansi, Cherat, Belgam, Bellary, and Kirkee are inclined to believe that the cases of inflammation of the inguinal glands returned by them as non-venereal were in reality probably of venereal origin, though definite proof was wanting.

Statistics show clearly how the arrival, year by year, of fresh batches of young unmarried men under the short service system has been accompanied by an increase of venereal disease. Since 1878 the number of fresh troops arriving in the country has, as a rule, been much greater than before. The gradual rise in the percentage of men under 25 years of age in the army, and of men under 5 years' Indian service has been pretty uniform, as has been the well-marked decline in the number of married men ; and the same .may be said of the gradual rise in the venereal ratio. As youth and recent arrival have become more common in the army, venereal disease and enteric fever have, not unnaturally, increased in frequency of occurrence.

The following table shows the admission-rate for venereal disease as far back as the records for India as a whole permit. The heading " primary syphilis " includes the local sore throughout :—

Venereal Diseases in the Army of India.

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.
1872	61·2	22·4	179·0	1885	122·1	28·7	342·7*
1873	53·4	20·4	166·7	1886	157·9	33·3	389·5*
1874	68·3	25·2	192·7	1887	142·1	29·4	361·2*
1875	67·1	25·1	205·1	1888	142·1	32·4	370·6
1876	59·8	23·9	189·9	1889	225·1	51·2	481·5
1877	65·2	22·1	208·5	1890	220·7	66·3	503·5
1878	95·3	22·0	271·3	1891	159·2	60·0	400·7
1879	79·2	24·5	234·8	1892	161·1	57·8	409·9
1880	87·9	23·1	249·7	1893	213·6	61·6	466·0
1881	92·0	23·1	260·5	1894	248·1	74·6	511·4
1882	87·6	23·2	265·2	1895	239·0	84·9	522·3
1883	87·2	23·5	270·3	1896	226·4	97·7	511·6
1884	90·2	24·4	293·9				

* Including troops on active service in Burma.

The figures in the above table show a more or less continuous rise, especially since the end of 1884 ; and the secondary syphilis ratio of 1896 is the highest on record. This is a condition of things which is sure to tell, when the men have to go on field service.

The following table, the data for which were specially obtained by the Principal Medical Officer, Her Majesty's Forces in India, from the medical officers concerned, and which excludes men on field service or on the march, distinguishes between the number of admissions and the number of individual men admitted into hospital for venereal disease in *1895* :—

Average annual strength.	Number of men admitted once only.	Number of men admitted twice but not oftener.	Number of men admitted three times but not oftener.	Number of men admitted four times or oftener.	Total number of men admitted.	Total admissions.
66,954	21,137	4,620	1,235	496	27,488	36,190

The number of individuals treated was about three-fourths the number of admissions ; and the former were in the proportion of 410·6 per 1,000 of strength, the latter of 540·5.

For every 10 men in the army affected by venereal disease there were about 14 free from the same ; or, in other words, in every 1,000 men 411 men were diseased and 589 exempt.

As ague and venereal diseases are the chief causes of admission, and enteric fever and hepatitis the chief causes of death in the European army of India, a table is here given to compare the last two lustres in the case of each of the stations that had in 1896 a strength of over 1,000 :— Past and present sickness and mortality.

Stations.		Admitted per 1,000.		Died per 1,000.		Stations.		Admitted per 1,000.		Died per 1,000.	
		Ague.	Venereal disease.	Enteric fever.	Hepatitis and abscess of liver.			Ague.	Venereal disease.	Enteric fever.	Hepatitis and abscess of liver.
Rangoon ...	1886–90	225·2	492·6	2·66	3·10	Mooltan ...	1886–90	238·4	530·5	4·25	·95
	1891–95	184·4	542·6	2·45	2·65		1891–95	571·2	460·3	4·11	·46
Fort Dufferin	1886–90	607·5	703·4	2·24	3·58	Kurrachee ...	1886–90	327·6	259·6	4·91	1·71
	1891–95	478·5	560·1	2·59	1·08		1891–95	924·9	327·2	1·65	·83
Fort William	1886–90	257·9	564·0	2·26	2·26	Agra	1886–90	294·9	499·4	7·27	·59
	1891–95	258·5	602·3	2·00	·91		1891–95	174·3	522·3	7·99	1·87
Fyzabad ...	1886–90	177·5	471·8	4·48	1·89	Mhow ...	1886–90	492·4	419·1	7·75	·55
	1891–95	194·5	576·1	3·65	1·46		1891–95	310·8	580·4	5·93	·97
Lucknow ...	1886–90	132·6	418·7	5·76	1·42	Poona ...	1886–90	227·8	398·0	3·26	·41
	1891–95	135·5	527·0	8·41	1·70		1891–95	321·9	545·5	6·81	1·18
Allahabad ...	1886–90	412·7	600·2	6·55	2·87	Belgam ...	1886–90	72·5	458·5	·61	1·42
	1891–95	310·5	651·0	3·51	1·24		1891–95	69·6	545·2	·38	·94
Bareilly ...	1886–90	192·9	505·4	11·73	1·42	Secunderabad	1886–90	43·8	387·9	7·53	1 68
	1891–95	107·5	693·3	7·33	1·11		1891–95	111·0	470·8	4·62	·70
Meerut ...	1886–90	530·1	509·0	5·59	1·00	Colaba ...	1886–90	233·2	444·9	1·43	·95
	1891–95	474·4	456·6	10·12	·92		1891–95	214·7	519·2	2·11	1·76
Umballa ...	1886–90	199·9	323·4	2·74	1·52	Bangalore ...	1886–90	26·2	338·9	4·04	1·04
	1891–95	247·2	407·7	8·11	·72		1891–95	51·8	444·0	2·93	·78
Ferozepore ...	1886–90	359·0	394·0	4·85	·61	Ranikhet ...	1886–90	78·1	441·1	7·26	2·13
	1891–95	929·3	345·2	5·00	·77		1891–95	80·6	636·1	3·73	1·04
Sialkot ...	1886–90	273·5	411·8	11·65	·86	Quetta ...	1886–90	526·5	203·7	3·53	1·31
	1891–95	598·8	423·8	6·24	·16		1891–95	759·6	308·0	2·81	1·00
Rawalpindi	1886–90	412·9	449·9	5·19	1·08	Wellington ...	1886–90	170·0	474·2	2·09	2·87
	1891–95	363·0	449·6	8·39	1·01		1891–95	98·5	394·6	2·73	·39
Peshawar ...	1886–90	641·2	380·4	5·74	·85	Aden ...	1886–90	191·3	227·0	1·96	1·71
	1891–95	983·7	239·7	10·09	·97		1891–95	819·0	306·7	1·69	1·06

There are 26 stations in the above list ; and 15 of them show an increase in ague, specially Ferozepore, Sialkot, Peshawar, Mooltan, Kurrachee, Secunderabad, and Aden. The prevalence of fever at Aden is under investigation. The venereal ratio of 19 stations rose, the greatest rise being at Ranikhet. The mortality from enteric fever was greater in 11 stations, and less in 15, the greatest increase taking place at Lucknow, Meerut, Umballa, Rawalpindi, Peshawar, and Poona, and the greatest decrease at Ranikhet and Sialkot. Hepatitis mortality fell at 19 stations, and rose at only 7 ; the greatest rise was at Agra, Poona, and Bombay, but no less than 9 stations showed large decrease. The general result over the whole is increase of sickness from ague and venereal disease, diminished mortality from enteric fever and hepatitis.

In the whole army of India 1,966 men were invalided, or 27·89 per 1,000 of strength, against 1,663 and 23·41 in the preceding year. The ratio for the decennium 1886–95 was 24·34. The proportion of invalids to strength was lowest in the Bombay command, highest in the Madras command. Invaliding.

—	1892.	1893.	1894.	1895.	1896.
India	40	39	39	33	39

Thirty-nine per cent. of the total number invalided were discharged as unfit for further service. The above table shows that this percentage was not at all out of the common.

Diseases causing Invaliding.—The following table shows the diseases which accounted for not less than 1 per 1,000 of strength :—

Invaliding Ratios per 1,000 of Strength.	—
Syphilis and gonorrhœa	6·77
Debility	2·61
Tubercle of the lungs	2·06
Malarial fevers	1·93
Dysentery	1·15
Valvular disease of the heart	1·08

The ratio of invaliding from mental diseases increased, having been unusually low in the preceding year. There were 39 cases of melancholia, 27 of dementia, and 21 of mania.

Ratios per 1,000 of Strength.	—
1886–95	1·19
1895	·77
1896	1·05

Invaliding according to Age and Indian Service.—The percentage of men who were invalided while under 25 years of age to the whole number invalided was (*f*) 62, against 66 in 1895. The percentage of men under 25 in the strength of the army was 56, against 55.

Of the total number of men invalided 40 per cent. were of less than two years' service, and 85 per cent. were of less than five years' service. With this is to be considered the fact that 82 per cent. of all the men in the strength of the army were of less than five years' service.

With regard to individual diseases the highest invaliding ratio per 1,000 of strength from venereal disease was in the age-period 20–24, and the relative liability for that period was 46 per cent. ; the actual number invalided for venereal disease in the same age-period was 306 ; of 100 invalidings in the same age-period 26 were due to venereal disease, a proportion only approached by that of the immediately succeeding age-period ; and of the total number invalided for venereal diseases at all ages 64 per cent. were in that same age-period. The residence-period 1–3 years, and especially the first half of the period, had the greatest proportion of invaliding for venereal disease ; whereas in 1895 it was more particularly the second half of the period 2–4 years which was so distinguished.

Statistics of officers.

The vital statistics of officers show that the death-rate for *all* in the British army was 14·18, and that for the Indian army 10·76. Both these ratios were higher than in the preceding year, the increase being from pneumonia, cholera, and circulatory diseases. The number of deaths from enteric fever among both British and Indian officers was exactly the same as in 1895. Enteric fever caused more deaths among the British than among the Indian officers, apparently because Indian officers have to serve first with British regiments, and it is known that youthful and newly-arrived men are more liable to take the disease than others.

The greatest numbers of cases of enteric fever at individual stations were 8 at Quetta, 6 at Poona, 3 at Meerut, and 3 at Kirkee. No special remarks are made on these cases, except as follows in the case of Meerut :—

" As to the R.A. officers, a bacteriological examination of the water supply of the lines, and also the " milk from the R.A. dairy was made at Agra, but no enteric microbe was detected. And it would " appear that the mess of the R.A. obtained their milk from the bazar, which probably may have " been the medium through which the microbe was conveyed. Since then this source of supply has " ceased."

Sickness and mortality among women rose; and it may be noted that the mortality of 1895 was already higher than that of 1894 :— Statistics of women.

Period.	Average annual strength.	Admission-rate per 1,000.	Constantly sick-rate per 1,000.	Death-rate per 1,000.
1886–95	31,881	815·2	32·1	17·00
1895	3,194	804·3	35·2	17·85
1896	3,254	807·0	37·4	18·44

The chief causes of admission were debility, ague, and the diseases peculiar to women. Among the diseases which caused increased admission were small-pox, influenza, and female diseases; while from enteric fever, malarial fevers, and bowel complaints admission was lessened. Debility caused nearly 35 per cent. of the total sickness, and ague 16 per cent.

The chief causes of death were enteric fever, child-birth and abortion, and tubercle of the lungs. Among the diseases which gave increased mortality were enteric fever and ague. Mortality from remittent fever, child-birth and abortion, cholera, and pneumonia was diminished. Enteric fever caused 18 per cent. of the total deaths, puerperal affections 8 per cent., and tubercle of the lungs 7 per cent. There was no cholera among the women.

That sickness among children in 1896 fell, while mortality rose, is seen in the following table :— Statistics of children.

Period.	Average annual strength.	Admission-rate per 1,000	Constantly sick-rate per 1,000.	Death-rate per 1,000.
1886–95	59,695	581·8	22·7	46·72
1895	5,699	598·5	26·2	41·24
1896	5,790	573·6	24·9	45·60

The chief causes of admission were ague and respiratory diseases. Among the diseases with raised admission-rates were small-pox, measles, and enteric fever; while admission from influenza, cholera, malarial fevers, respiratory diseases, and bowel complaints was lessened. Ague caused 16 per cent. of the total sickness, respiratory diseases 13 per cent., and measles and diarrhœa each 7 per cent.

The chief causes of death were convulsions, debility (including immaturity at birth), diarrhœa, and teething. Among the diseases from which there was increased mortality were small-pox, diphtheria, enteric fever, convulsions, respiratory diseases, teething, and dysentery. Mortality from remittent fever, cholera, diarrhœa, and debility was diminished. Convulsions caused 14 per cent. of the total deaths, debility nearly 14 per cent., diarrhœa over 12 per cent., and teething nearly 12 per cent. There were no cases of cholera among children in 1896.

Native Troops.

Sickness and mortality in 1896.

Owing, no doubt, to the dry and non-malarious character of the year, there was less sickness and mortality than in 1895, even though influenza and cholera were more prevalent :—

Year.	Average strength.	Ratio per 1,000. Admissions into hospital.	Constantly sick.	Deaths from: Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.	Mortality, including absent deaths.
1886–95 ...	123,302	976	34	1·32	1·34	3·02	·78	12·43	16·72
1895	129,655	794	30	·41	1·20	4·20	·53	11·60	15·71
1896	128,286	763	29	·69	1·07	3·14	·42	10·20	12·57

The chief cause of admission was ague. Among the diseases with raised admission-rates were influenza, cholera, small-pox, and venereal disease. Among those with lessened rates were enteric fever, ague, remittent fever, simple continued fever, pneumonia, other respiratory diseases, dysentery, and diarrhœa. Ague caused 36 per cent. of the total admissions.

The chief causes of death were pneumonia and remittent fever. Among the diseases which caused increased mortality were cholera and small-pox. Among those from which mortality was lessened were respiratory diseases, bowel complaints, and fevers. Pneumonia caused 31 per cent. of the total deaths, and remittent fever between 10 and 11 per cent.

The total number invalided for discharge was 1,437, and the chief causes of invaliding were debility, venereal diseases, and respiratory diseases.

If the following table be compared with that at page 45 it will be seen that the Native soldier suffered less from influenza, small-pox, enteric fever, simple continued fever, tubercle of the lungs, diarrhœa, hepatic affections, and venereal diseases, and more from ague, remittent fever, respiratory diseases, dysentery, and scurvy than his European comrade. These relations are usual, except with regard to influenza and small-pox.

Ratios of Commands.

	Ratio per 1,000 of the Average Strength. Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Central India and Rajputana Corps.	Hyderabad Contingent.	Army of India.
I.—Average Annual Strength ...	26,279	38,824	25,009	24,707	5,062	6,970	128,286
II.—Constantly Sick-rate of the Year.	30·7	28·9	31·0	28·1	20·5	19·2	28·6
III.—Admission-rate of the Year :							
Influenza	7·3	13·1	5·4	17·6	8·3	8·2	10·7
Cholera	2·0	·2	1·0	·8	3·8	1·3	1·0
Small-pox	·9	·9	2·0	1·3	1·4	·3	1·2
Enteric fever	·5	·1	—	·2	—	—	·1
Intermittent fever	301·1	257·0	224·5	352·9	215·9	225·4	276·2
Remittent fever	15·8	24·0	4·0	19·1	12·8	11·8	16·2
Simple continued fever	10·0	2·7	11·7	19·5	20·3	2·2	9·9
Tubercle of the lungs	3·7	3·3	1·6	1·5	1·8	·6	2·5
Pneumonia...	14·8	23·4	5·2	12·1	24·1	15·8	15·3
Other respiratory diseases ...	24·9	34·5	22·0	30·9	21·9	13·8	27·5
Dysentery	44·0	42·7	30·1	41·9	18·6	25·1	39·1
Diarrhœa	14·0	10·0	7·3	13·1	8·3	1·4	10·5
Hepatic abscess	·1	—	—	·2	—	—	·1
„ congestion and inflammation.	1·3	1·0	1·3	1·3	1·0	1·3	1·2
Scurvy	1·4	5·0	·2	6·9	1·0	1·7	4·1
Venereal diseases	50·7	23·9	46·9	45·0	19·0	14·2	37·1
All Causes	808·6	766·1	665·0	880·0	630·4	563·4	762·6

Ratios of Commands—continued.

	Ratio per 1,000 of the Average Strength.						
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Central India and Rajputana Corps.	Hyderabad Contingent.	Army of India.
IV.—Death-rate of the Year:							
Cholera	1·48	·10	·64	·53	2·17	·72	·69
Small-pox	·08	·13	·04	·20	—	—	·10
Enteric fever	·15	—	—	·04	—	—	·04
Intermittent fever	·30	·41	1·08	·32	·40	—	·48
Remittent fever	·72	1·83	·56	·97	·79	·72	1·07
Simple continued fever	—	·03	—	·08	·20	—	03
Circulatory diseases	·11	·08	·28	·24	—	·14	·16
Tubercle of the lungs	1·18	·93	·24	·32	·59	—	·65
Pneumonia...	1·45	6·21	1·08	2·10	3·95	3·30	3·14
Other respiratory diseases ...	·34	1·11	·12	·61	·20	·43	·58
Dysentery	·42	·33	·68	·40	·40	·14	·42
Diarrhœa	·19	·05	·12	·32	—	—	·14
Hepatic abscess	·04	·05	·08	·16	—	—	·07
Anæmia and debility	·04	·18	·44	·16	—	—	·18
All Causes	8·52	14·37	8·04	8·82	10·47	7·03	10·20

Of the commands the Punjab was the most unhealthy, but it was more healthy than in the previous year. Its death ratios from cholera, small-pox, and hepatic abscess were raised, while those from enteric fever, ague, remittent fever, pneumonia, other respiratory diseases, dysentery, diarrhœa, and debility were lowered. The Punjab had the highest death-rate, Madras the highest constantly sick-rate, and Bombay the highest admission-rate. The highest ratios of mortality from remittent fever, pneumonia, and other respiratory diseases, and the lowest from cholera, were in the Punjab; the highest from ague, dysentery, and debility, and the lowest from remittent fever, pneumonia, and other respiratory diseases, in Madras; the highest from small-pox, diarrhœa, and hepatic abscess in Bombay.

The following table shows the statistics of all the native troops serving in Burma and the Andamans. Of these troops in 1896 about 98 per cent. belonged to the Madras army:—

Year.	Average annual strength present.	Ratio per 1,000.						
		Admissions into hospital.	Constantly sick.	Deaths from				
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.
1891	11,401	1,676	76	1·75	2·98	1·84	4·03	36·31
1892	11,333	1,349	57	2·29	2·29	2·29	3·09	29·12
1893	10,326	1,092	48	·87	1·45	2·42	1·36	19·85
1894	10,500	809	35	1·43	·95	1·14	1·43	13·90
1895	9,952	827	37	·80	·50	·80	·80	10·55
1896	9,605	830	38	—	·94	·73	1·35	9·58

The table shows that the death-rate has been reduced year by year. Sickness was not high, though higher than in the previous year. A comparison of the health of the troops

in the Burma Coast group of stations with that of the troops in the Burma Inland group may be made by the use of the following table :—

Ratios of Geographical Groups.

	Ratio per 1,000 of the Average Strength.												
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
	Burma, Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Army of India.*
I.—Average Annual Strength	2,324	6,680	1,774	3,113	6,780	16,176	14,776	12,283	20,434	2,731	8,736	17,071	128,286
II.—Constantly Sick-rate of the Year.	19·6	45·9	44·5	36·1	24·8	24·2	27·4	26·0	26·2	27·3	28·5	38·6	28·6
III.—Admission-rate of the Year:													
Influenza	—	13·2	11·8	4·8	11·1	1·3	13·8	8·7	4·1	—	4·8	35·4	10·7
Cholera	—	—	20·9	·6	·6	·6	·2	1·8	1·6	—	2·3	—	1·0
Small-pox	—	·4	—	—	·7	1·7	·8	2·4	1·6	1·1	2·5	·6	1·2
Enteric fever	—	—	1·7	·3	·6	·2	·1	·3	—	—	·1	·1	·1
Intermittent fever ..	79·2	493·3	391·2	308·1	161·7	164·7	288·2	237·3	340·4	121·9	112·3	425·6	276·2
Remittent fever	2·6	5·4	16·3	4·5	16·7	23·7	22·1	11·4	13·2	28·6	3·4	25·7	16·2
Simple continued fever ..	2·6	3·1	16·3	42·1	·6	5·9	2·5	21·7	14·8	19·0	23·2	5·6	9·9
Tubercle of the lungs ..	1·7	1·9	3·4	1·9	3·1	4·5	3·2	2·2	1·4	2·6	·9	3·7	2·5
Pneumonia	1·3	3·6	8·5	13·8	5·9	15·8	27·7	21·3	14·1	4·4	5·2	20·9	15·3
Other respiratory diseases	12·0	31·9	28·2	32·8	26·5	23·1	34·7	24·8	18·2	22·0	21·6	36·4	27·5
Dysentery	65·0	39·4	85·7	69·1	33·0	19·2	40·5	31·8	28·6	44·7	25·5	40·9	39·1
Diarrhœa	6·0	14·1	65·4	17·0	6·8	4·3	10·8	8·6	4·4	13·9	4·5	18·6	10·5
Hepatic abscess	—	—	—	—	—	·1	·1	—	·1	·4	·1	·1	·1
„ congestion and inflammation.	·9	1·2	·6	1·6	·9	·9	1·2	·9	1·4	2·9	1·3	1·8	1·2
Scurvy	—	·3	—	1·3	1·3	1·7	4·1	2·7	2·1	1·1	—	6·7	4·1
Venereal diseases	25·4	44·5	98·1	26·0	33·9	28·6	19·1	41·0	41·6	74·7	51·4	56·8	37·1
All Causes ..	475·9	981·6	1,149·4	868·3	598·4	610·3	820·7	713·4	785·4	606·7	577·7	1,034·7	762·6
IV.—Death-rate of the Year:													
Cholera	—	—	14·09	·64	29	56	·07	·98	·98	—	1·37	—	69
Small-pox	—	—	—	—	·15	·06	·34	·33	·05	—	—	·0 (	·10
Enteric fever	—	—	·56	—	·29	—	—	·16	—	—	—	—	·04
Intermittent fever	2·15	2·84	—	·64	·44	·31	·54	·24	·20	—	—	·18	·48
Remittent fever	—	1·35	1·69	—	·74	1·55	1·82	·65	·69	1·46	·46	1·17	1·07
Simple continued fever ..	—	—	—	—	—	—	—	·08	·05	—	—	·06	·03
Circulatory diseases ..	—	·30	·56	—	·15	—	·14	·16	·24	·37	·34	·12	·16
Tubercle of the lungs ..	—	·45	1·13	·32	·88	1·30	·34	·65	·20	·37	·23	1·64	·65
Pneumonia	—	1·05	·56	2·25	·29	3·46	9·20	2·93	2·30	1·10	1·26	3·57	3·14
Other respiratory diseases	·43	—	—	·32	·29	1·24	1·29	·33	·54	—	·23	·29	·58
Dysentery	·43	1·65	—	·64	·29	·25	·27	·49	·20	·37	·34	·41	·42
Diarrhœa	·43	·15	·56	·64	—	·06	—	—	·15	1·83	—	—	·14
Hepatic abscess	·43	—	—	—	—	·06	·07	—	·15	—	·11	·06	·07
Anæmia and debility ..	·86	·75	—	—	—	·12	·14	·08	·10	1·10	·11	·12	·18
All Causes ..	6·88	11·08	21·98	7·71	5·46	11·07	17·66	9·04	7·24	9·89	7·67	10·25	10·20

* Including Group Extra-India. For complete detail of diseases *see* Table LIII.

The following table shows that both for the decennium and in 1896 Groups II. and III. had high constantly sick ratios; and that both for the decennium and in 1896 mortality from respiratory diseases was greatest in the Indus Valley:— Geographical groups.

		Ratio per 1,000 of Strength.												
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.
		Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia-Nagpur.	Upper Sub-Himalayan.	N. W. Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	India.
1886-1895.	Constantly sick-rate...	48·9	65·8	62·8	48·2	28·9	31·6	37·1	27·6	28·3	23·4	26·2	42·3	33·6
	Death-rates from—													
	Cholera	—	4·47	·70	·59	1·14	·82	·80	·69	·87	·14	1·31	1·29	1·32
	Respiratory diseases	1·43	2·35	2·43	1·25	1·57	4·56	6·79	2·69	1·60	1·08	1·56	6·43	3·60
1895.	Constantly sick-rate...	24·4	42·9	39·0	37·0	23·1	29·9	35·0	21·4	26·8	29·8	26·1	36·0	29·9
	Death-rates from—													
	Cholera	—	1·20	—	—	1·69	—	—	·69	·77	—	·99	—	·41
	Respiratory diseases	1·87	·75	2·88	·99	1·23	4·57	12·16	3·21	2·17	·65	1·32	5·78	4·87
1896.	Constantly sick-rate...	19·6	45·9	44·5	36·1	24·8	24·2	27·4	26·0	26·2	27·3	28·5	38·6	28·6
	Death-rates from—													
	Cholera	—	—	14·09	·64	·29	·56	·07	·98	·98	—	1·37	—	·69
	Respiratory diseases	·43	1·05	·56	2·57	·59	4·70	10·49	3·26	2·84	1·10	1·49	3·87	3·72

In the above table it may be seen that Burma Coast had the lowest admission ratios from malarial fevers and respiratory diseases; Burma Inland the highest from ague; Assam the highest from cholera, enteric fever, dysentery, diarrhœa, and venereal disease; Bengal-Orissa the highest from simple continued fever; Indus Valley the highest from pneumonia; Western Coast the highest from remittent fever and hepatitic affections; Southern India the highest from smallpox, and the lowest from dysentery; and the Hills the highest from influenza and from respiratory diseases other than pneumonia. The presence of enteric fever and the prevalence of venereal disease in Assam is due to the number of Gurkha troops there.

Of the large stations throughout India with a strength of not less than 1,000 the following returned the highest death-rates:—Manipur, 37·66; Nowshera, 37·77; Peshawar, 21·34; Kohat, 19·25; Dera Ismail Khan, 19·19.

The principal cause of death at Manipur was cholera, at the four frontier stations pneumonia.

Attention having been directed to the health statistics of India, of the commands, of the geographical groups, of stations, and of regiments, it will be convenient now to consider some of the chief diseases. Influenza increased, there having been 1,369 cases, 10·7 per 1,000 of strength, against 910 cases, 7·0 per 1,000 of strength, in the preceding year. There was more influenza in 1896 than there had been since 1892. The geographical groups affected both in 1895 and in 1896 were IV., V., VI., VII., VIII., IX., XI., XII.; II. and III. were newly attacked in 1896; X. escaped in both years, while I. has had no cases since 1892. In proportion to strength the Hills was, as in the previous year, the group most severely affected; whilst the greatest number of cases occurred, as in 1895, in the Hills and Indus Valley. The following table shows the monthly progress of of the disease since its beginning in 1890. The maximum month varied from year to Principal diseases: Influenza.

year, but over the period as a whole most cases occurred in April and March, and fewest in October and September :—

Years.	Number of Admissions into Hospital each month.												Total.	Admitted per 1,000 of Strength.	Died per 1,000 of Strength.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.			
1890 ...	1	8	2,460	5,118	492	82	55	—	—	—	1	—	8,217	64·3	·41
1891 ...	—	—	1	—	105	259	123	106	51	22	17	215	899	7·0	·09
1892 ...	681	371	511	149	40	5	5	7	—	1	7	18	1,795	14·1	·15
1893 ...	8	28	65	99	95	13	9	7	—	3	53	404	784	6·2	·20
1894 ...	159	203	232	384	143	11	5	—	1	1	5	11	1,155	9·0	·16
1895 ...	26	28	53	76	110	25	60	57	19	17	31	408	910	7·0	·08
1896 ...	372	196	397	35	22	11	33	57	53	39	82	72	1,369	10·7	·30
Total	1,247	834	3,719	5,861	1,007	406	290	234	124	83	196	1,128	15,129	16·9	·20

The greatest number of cases occurred at Quetta, Dharmsala, and Edwardesabad. At the first named station the disease was present during the last six months of the year, while in the other two it was confined to the first four and first two months of the year respectively. The following table shews that in 1896, as in the previous year, the native troops were somewhat less severely affected than the European troops, much less severely than the prisoners :—

Years.	Per 1,000 of Average Strength.											
	Influenza.						Pneumonia.					
	European Troops.		Native Troops.		Prisoners.		European Troops.		Native Troops.		Prisoners.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1890	33·4	·03	64·3	·41	78·6	·67	4·6	·90	16·7	3·96	18·5	5·71
1891	5·5	·04	7·0	·09	19·0	·29	2·6	·54	11·6	2·53	17·0	4·87
1892	12·7	·01	14·1	·15	56·7	1·26	3·5	·62	13·6	3·26	18·4	5·56
1893	·3	—	6·2	·20	6·4	·09	3·4	·70	12·3	2·75	15·9	3·95
1894	3·4	·01	9·0	·16	41·0	·43	3·7	·75	12·9	2·87	15·4	4·31
1895	7·8	·03	7·0	·08	20·3	·15	4·4	·51	17·5	4·20	16·4	4·00
1896	11·5	·11	10·7	·30	37·6	·60	5·2	·64	15·3	3·14	19·1	4·34

It also shows the relation of the pneumonia death-rate year by year to the admission-rate from influenza. In comparing 1896 with 1895 from this table it must be remembered that the unusual height of the death-rate from pneumonia in 1895 was the result of field service in Waziristan and Chitral.

Cholera.

There were 132 cases of cholera with 88 deaths, against 75 cases with 53 deaths in the preceding year. The admission-rate per 1,000 was 1·0, against 0·6, and the death-rate 0·69, against 0·41. Cases occurred in every month except January and February, the maximum months being June–August. The greatest number of cases occurred in Assam and the Deccan. Among stations Manipur had most cases, namely, 37, the greatest number at any other station being ten. The regiment affected at Manipur was the 44th Gurkha Rifles, the explosion of the disease being attributed to pollution of the river by the dejecta of cases in the civil population.

The following table gives information regarding the cholera of the period 1886–95 :—

—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000. Admitted	Ratio per 1,000. Died.
European troops	6	4	22	76	126	67	285	336	177	91	65	25	1,280	1·9	1·33
Native troops ...	72	152	52	305	401	220	490	313	227	140	169	112	2,653	2·2	1·32
Prisoners ..	263	83	241	437	352	334	1,115	873	269	146	311	184	4,608	4·8	2·75

In the period as a whole the European troops suffered less than the native troops, and both less than the prisoners. In each of the 10 years, except 1890, the prisoners were most affected, and in a slight majority of years the European troops least. The table also shows that August and July were the maximum months for European troops, July and May for native troops, and July and August for prisoners.

Small pox.

There were 148 cases of small-pox with 13 deaths, against 71 cases with 8 deaths in the preceding year. The admission ratio per 1,000 was 1·2, against 0·5, and the death ratio 0·10, against 0·06.

Fevers.

To ague was due 36 per cent. of the sickness of the native army. The admission-rate from ague fell in 1896. Statistics show that in 1896, as in 1895, Burma Inland was the most malarious group, and Burma Coast the least malarious ; and the most malarious months were September and October, and the least malarious month February. Remittent fever caused over 10 per cent. of the total deaths, and prevailed most in September and October. The proportion of cases returned as simple continued fever is much lower in the native army than in the European ; but it is pretty certain that many cases, which in the latter would be so returned, are in the former called ague. The simple continued fever of the native army was most prevalent in April–June, and in the same period the greatest number of enteric fever cases were diagnosed.

Several medical officers mention the benefit derived by the regiments in their medical charge from the prophylactic issue of quinine and other anti-periodics ; and there is no doubt that the regular issue of the same is a practice which ought to be strongly encouraged throughout the army. The medical officer of the 27th Bombay Infantry at Hyderabad (Sind) states that ague was much increased by the water having been allowed to run into the canals and channels in and around Hyderabad this year.

The ratio of admission from enteric fever in the native army in 1896 was 0·1 per 1,000 of strength, and the death-rate 0·04, against 0·2 and 0·07 in the previous year. The corresponding decennial ratios of 1886–95 are 0·2 and 0·08. The following table shows that the ratios for European troops are very unlike those for native troops and prisoners :—

—	1886–95. Admissions.	1886–95. Deaths.	1896. Admissions.	1896. Deaths.
European troops	19·6	5·28	25·5	6·31
Native troops	·2	·08	·1	·04
Jail population	·3	·12	·2	·05

Post-mortems are rarely obtainable in the case of native soldiers ; but among prisoners nearly every fatal case of disease is subjected to *post-mortem* examination. Under these circumstances, as has been repeatedly pointed out, the fact that the ratios of prisoners and sepoys for a ten year period are almost identical appears to show that the native troops really suffer less than the European ; though it does not show that there may not be more cases of enteric fever among both native troops and prisoners than are at present diagnosed during life or after death. Again, the following table shows that the total fever mortality

in the two armies is not the same in amount, which indicates that the difference is not altogether a mere matter of diagnosis :—

Causes of Death.	Died per 1,000 of Average Strength.		Relative Liability in Percentages.			Percentage in Deaths from all causes.	
	European Troops.	Native Troops.	European Troops.	Native Troops.	Total = 100	European Troops.	Native Troops.
Ague	·10	·48	17	83	100	·7	4·7
Remittent fever	·40	1·07	27	73	100	2·7	10·5
Simple continued fever	—	·03	—	100	100	—	·3
Enteric fever	6·31	·04	99	1	100	42·5	·4
Total	6·81	1·61	81	19	100	45·9	15·9

The total fever mortality among the native troops in 1896 was to the total fever mortality among the European troops as 1 : 4·2. For the period 1886–95 the corresponding ratio was 1 : 2·6 and for 1895 it was 1 : 3·9. Again, among the European troops, 46 per cent. of all deaths in 1896 were from fevers; only 16 per cent. among native troops. As the death-rate of European troops from enteric fever is nearly four times as great as that of native troops from all kinds of fever, it appears, whatever may be the nature of the remittent and continued fevers from which native soldiers die, that native soldiers and prisoners are less liable to enteric fever than European soldiers are.

The question of the immunity, or apparent immunity, of natives of India as regards enteric fever, has been frequently discussed in former reports. At page 62 of the report for 1895, and at page 33 of that for 1890, was noticed the suggestion that the modern British soldier has become very liable to contract the disease in badly sanitated India, because in now purer England he has not had the opportunity of going through the disease at an earlier age. The same view had since been led up to in a different way by Surgeon-Major S. F. Freyer, Army Medical Staff, who by the use of Widal's serum test thinks he has discovered that nearly all natives of India above the age of early childhood have already passed through the disease. That they have may or may not be true, and it has been mentioned in these reports that some medical officers in India believe it to be true; but Surgeon-Major Freyer's intended proof cannot be accepted without further confirmation, especially as his own paper shows that he did not realise the necessity of minute care and strictness in the experiments. His results were criticised from this point of view by Mr. A. M. Gossage, and the references given here will show that the latter was justified in his criticism. The danger of error arises from the fact that the reaction is not only qualitative but also a quantitative one, there being a small amount of agglutinative power in normal sera, so that certain limits of dilution and time have to be observed. Again, cultivations which are not quite fresh often begin to a certain degree to clump spontaneously, and this danger has to be guarded against by microscopic examination of the culture before use. It has also been found that the composition, reaction, and temperature of the medium in which the cultivation is made have something to do with the readiness with which agglutination may be displayed. Therefore, before undertaking the experimental diagnosis, it is necessary to make sure of the genuineness, purity, freshness, activity, virulence, and freedom from clumps of the culture; and thereafter to find out the relation, within the limits of the intended dilution and time-allowance, of these genuine bacilli to a serum known to be normal. It is evident from what has been said that an inexperienced experimenter is in most danger of getting an erroneous *positive* result; and that the test is not one to be trifled with by the general practitioner, but to be entrusted only to the hands of the bacteriological expert, who realises the sources of fallacy to be avoided. As Professor Sheridan Delépine says :—

"The simplicity of the method may induce clinicians to use it at the bedside. I doubt whether "this would be a wise application. The whole method depends for its success on the purity "of the cultures, on their being in an active state of growth, on their being free from clumps, "and on the observations being made by men to whom bacteriological observations are so familiar as "to prevent those many slight sources of inaccuracy which attend experiments made by those who

" are not in constant training. The very simplicity of the method is for these reasons a source of " danger, and I should not be surprised if the generalisation of the method were attended by disbelief " in its value, if it is to be used indiscriminately by anybody who happens to possess a tube labelled " 'typhoid bacillus' and a platinum loop."

In the whole native army of India 19 cases with 5 deaths were returned as enteric fever, as against 22 cases with 9 deaths in 1895. In only three cases were *post-martems* obtained; and the lesions described support the diagnosis. Regarding the three cases that occurred at Manipur, the medical officer of the 44th Gurkhas says :—

" The three cases occurred soon after each other. They came from different companies; two from " one and one from another. The source of contagion was not traced; probably the river water was " to blame, as it was at the beginning of the rains. There is always a lot of simple continued fever " about that time of the year; and I strongly suspect that at least some of these are cases of enteric " fever in which the diarrhœa is absent or very slight. All are treated as if they were."

Both morbidity and mortality from respiratory diseases were less than in 1895, and were also unusually low :— Respiratory diseases.

Period.	Ratio per 1,000 of Strength.			
	Respiratory Diseases.		Pneumonia.	
	Admissions.	Deaths.	Admissions.	Deaths.
1886–95	50	3·75	13	3·02
1895	53	4·87	18	4·20
1896	43	3·72	15	3·14

Respiratory diseases are the chief cause of death in the native army, and in 1896 over 36 per cent. of all deaths were due to them. For respiratory diseases other than pneumonia, the highest admission ratios were those of the Hills, Indus Valley, Bengal-Orissa, and Burma Inland, and the lowest that of Burma Coast. Of commands the Punjab has the highest death-rate, and Madras the lowest.

The admission and death ratios from pneumonia, as may be seen from the table given in the preceding paragraph, fell considerably; but were still, nevertheless, above the decennial ratios. The ratios of 1895 had been unusually high owing to the exposure endured by the regiments on active service in Waziristan and Chitral. Again, the second table on page 68 shows how far the yearly increase or decrease of influenza has affected the pneumonia death-rate. If the following be compared with the same table, it will be seen that the influenza prevalence, which began in 1890, has caused pneumonia mortalities to run higher :— Pneumonia.

Years.	Ratio per 1,000 of Average Strength.			Years.	Ratio per 1,000 of Average Strength.		
	European Troops.	Native Troops.	Prisoners.		European Troops.	Native Troops.	Prisoners.
1883 ...	·58	3·31	3·98	1887 ...	·54	2·81	4·53
1884 ...	·53	2·33	4·08	1888 ...	·49	2·28	4·36
1885 ...	·75	2·94	4·00	1889 ...	·46	2·66	4·94
1886 ...	·48	2·75	4·22				

The admission and death ratios were, as usual, highest in the Indus Valley, and the percentage of pneumonia to total deaths was there also highest. Both in the Indus Valley and in the Hills pneumonia was most prevalent in the cold months; and the same was the case for India as a whole.

From dysentery, the admission and death rates were considerably lower than in the preceding year. The comparative prevalence and mortality from dysentery in the various Dysentery, diarrhœa.

portions of the army of India may be studied in tables on pages 64, 65 and 66. The highest admission-rates were in the Bengal command, and the Assam group; the highest death-rates in the Madras command, and in the Burma Inland group. The death-rate of native troops from dysentery was to that of European troops as 1 : 1·6; and the percentage of dysentery in total cases of death was 4·1 in the case of native troops, and 4·5 in the case of European troops. Again, the case-mortality of native troops was 1·01 per cent., while that of European troops was 2·38. The admission-rate of native troops, however, was much higher than of European troops, 39·1 to 26·1.

Venereal diseases.

Details regarding venereal diseases in 1896 will be found in the tables on pages 64 and 66. The following table is given to compare with the corresponding one for European troops on page 60 :—

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.
1877	11·5	5·3	26·7	1887	12·6	6·1	27·4
1878	16·3	5·8	37·5	1888	13·5	5·4	31·5
1879	16·5	7·0	37·1	1889	16·6	6·4	38·9
1880	15·0	5·8	33·3	1890	16·0	6·9	41·1
1881	17·9	7·2	39·5	1891	13·6	6·9	37·9
1882	14·7	5·9	34·4	1892	14·1	7·9	39·6
1883	13·0	6·5	31·6	1893	13·3	9·0	36·4
1884	11·0	5·3	27·9	1894	13·8	8·2	32·3
1885	11·2	5·9	30·1	1895	13·1	7·3	31·3
1886	13·7	6·0	28·1	1896	15·5	8·9	37·2

The figures for India are not available for the years before 1877. All the venereal ratios of native troops run at a much lower level than those of European troops; and there is not the same tendency to increase in the ratios of the former as in those of the latter, there having been no change in the native army corresponding to the introduction of the short service system in the European army.

A comparison of the tables on pages 45 and 64 and 65 will show that, leaving Central India, Rajputana, and Hyderabad out of account, the lowest ratios for both European and native troops were those of the Punjab command, and the highest those of the Bengal command. In all the commands the ratios of native troops were much lower than those of European troops.

Whilst among the European troops an average strength of 70,484 gave 36,058 admissions, in the case of the native troops an average strength of 128,286 gave only 4,757 admissions. In other words, there were only 37 admissions for every 1,000 men among native troops, against 512 for every 1,000 men among European troops.

The admission-rate for India was 5·8 per 1,000 more than in 1895. There were 8 deaths and 89 invalidings directly due to venereal disease. Among stations with high ratios, with great increase of ratio, with much secondary syphilis, those occupied by Gurkhas are prominent. Nine more stations than in the previous year had ratios over 20 per 1,000 from secondary syphilis, and 16 more, ratios over 10 per 1,000.

Beri-beri. Dochmius.

All of the 81 cases returned as beri-beri occurred in the Madras command, and of the 13 deaths 6 occurred in Burma and 7 in the peninsular part of the Madras command. In the 20th Madras Infantry at Vizianagram occurred 35 cases with 3 deaths, principally among the Tamil recruits, and in the 17th Madras Infantry at Rangoon 20 cases with 3 deaths. Nothing of importance is contributed as regards etiology, though the medical officer of the latter regiment describes the symptoms and treatment with some care. No cases of sickness or death caused by the *dochmius duodenalis* were reported.

Jails.

Sickness and mortality in 1896.

The year 1896 having been, as already stated, comparatively settled, dry, rainless, and bright, sickness was less than usual, specially sickness due to malaria; but, on the other hand, there was more or less food scarcity, and influenza and cholera were more prevalent.

Year.	Average Annual Strength.	Ratio per 1,000.									
		Admissions into Hospital.	Constantly Sick.	Deaths from							
				Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases	Phthisis Pulmonalis	Anæmia and Debility.	All causes.
1882–91*	89,642	1,093	38	2·91	1·60	6·84	3·93	5·99†	2·37	2·16	33.61
1895* ...	106,337	1,082	44	·80	1·20	7·15	2·31	5·14	2·54	1·49	27·61
1896* ...	110,090	983	41	1·27	1·07	5·91	1·98	5·28	3·07	1·43	27·69

* Excluding subsidiary jails. † From 1886.

The chief causes of admission to hospital were ague; abcess, ulcer, and boil; dysentery; and diarrhœa. Among the diseases with raised admission-rates were influenza, cholera, small-pox, simple continued fever, tubercle of the lungs, and pneumonia; while the rates from enteric fever, ague, remittent fever, respiratory diseases other than pneumonia, dysentery, diarrhœa, and scurvy were lowered. Ague caused 28 per cent. of the total sickness, and bowel complaints 16 per cent.

The chief causes of death were dysentery, pneumonia, tubercle of the lungs, and diarrhœa. Among the diseases with increased mortality were cholera, tubercle of the lungs, and pneumonia. Among those with lessened mortality were enteric fever, remittent fever, respiratory diseases other than pneumonia, dysentery, diarrhœa, and debility. Dysentery caused 21 per cent. of the total deaths, pneumonia 16 per cent., and tubercle of the lungs 11 per cent.

The following statement shows for each administration, except the Andamans, the proportion of prisoners in 10,000 of the population. Some of the prisoners of each province have been transported to the Andamans, and these are necessarily excluded from the calculations; so that the ratios are all somewhat too low :—

Administrations.	Period.	General Population According to Census of 1891.	Prisoners.		
			Average Number.*	Proportion per 10,000 of Population.	Deaths per 1,000 of Average Strength.*
Burma	1895	7,605,560	13,666	18·0	17·93
	1896		14,460	19·0	18·19
Assam	1895	5,476,833	1,436	2·6	59·19
	1896		1,534	2·8	50·85
Bengal	1895	71,346,987	16,926	2·4	27·53
	1896		17,495	2·5	28·64
North-Western Provinces and Oudh.	1895	46,905,085	31,604	6·7	28·38
	1896		32,984	7·0	28·83
Punjab	1895	20,866,847	11,565	5·5	21·62
	1896		12,021	5·8	15·64
Bombay	1895	18,901,123	8,382	4·4	29·23
	1896		8,256	4·4	31·98
Berar and Secunderabad	1895	2,897,491	1,424	4·9	23·88
	1896		1,432	4·9	25·14
Central Provinces ...	1895	10,784,294	4,951	4·6	55·95
	1896		5,583	5·2	72·36
Madras	1895	35,630,440	9,790	2·7	18·19
	1896		9,584	2·7	19·51

* Including subsidiary jails.

The following table compares the ten administrations with each other, and the present of each administration with its past :—

—	Year.	Average Annual Strength.	Ratio per 1,000.* Admissions.	Constantly Sick.	Deaths from Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
Andamas	1882–91	11,801	1,739	61	—	3·11	4·86	2·52	3·78†	4·31	1·43	28·72
	1895	10,259	1,648	52	—	5·26	8·19	4·48	1·95	2·53	3·51	31·09
	1896	10,520	1,350	46	—	2·19	6·08	1·43	2·28	3·80	1·43	23·29
Burma	1882–91	8,339	983	41	7·78	1·32	9·79	2·91	4·15†	2·58	3·26	42·09
	1895	13,666	891	38	1·17	·88	3·37	·73	2·20	3·22	·29	17·93
	1896	14,460	759	35	·55	·62	2·97	·83	2·77	4·50	·28	18·19
Assam	1882–91	1,201	1,978	58	5·41	1·92	13·58	6·58	5·65†	1·00	4·08	48·06
	1895	1,200	1,262	64	1·67	—	17·50	12·50	5·00	2·50	5·00	66·67
	1896	1,273	1,034	53	1·57	3·14	13·35	6·28	5·50	3·14	6·28	56·56
Bengal	1882–91	13,984	1,373	47	5·65	1·95	13·62	5·46	4·68†	3·58	2·21	46·14
	1895	16,103	1,211	43	1·74	1·06	8·14	1·80	3·23	3·10	·99	26·95
	1896	16.542	1,221	40	3·75	1·57	7·38	1·15	3·32	3·14	1·27	29·20
N.-W. P. and Oudh.	1882–91	22,617	727	29	1·67	·82	4·90	2·55	6·37†	1·83	2·01	25·62
	1895	31,296	914	57	·32	·35	8·21	2·30	6·01	1·92	2·01	28·31
	1896	32,830	892	51	·49	·73	4·75	2·38	7·74	2·44	2·50	28·82
Punjab	1882–91	11,935	1,370	33	1·29	1·52	4·15	3·46	11·50†	1·58	1·05	31·91
	1895	11,415	1,446	35	—	·44	2·10	·35	9·29	2·72	·26	21·73
	1896	11,894	1,234	31	—	·67	1·68	·67	4·29	1·85	·17	15·64
Bombay	1882–91	6,916	698	25	1·43	2·62	3·15	3·76	8·51†	1·55	2·07	31·18
	1895	7,212	1,010	33	·69	1·25	5·27	4·99	8·73	3·33	1·25	31·89
	1896	7,052	895	35	3·67	1·97	3·24	2·82	9·87	2·26	·85	33·56
Berar and Secunderabad.	1882–91	1,048	571	14	·86	1·34	·76	1·14	2·59†	1·43	·57	14·21
	1895	1,424	876	23	—	1·40	2·81	·70	6·32	1·40	2·11	23·88
	1896	1,432	594	18	1·40	—	·70	·70	7·68	·70	4·89	25·14
Central Provinces.	1882–91	3,998	954	33	5·15	1·65	12·73	11·88	5·91†	1·15	5·10	52·87
	1895	4,951	922	35	3·03	1·41	23·03	6·46	7·08	2·83	3·23	55·95
	1896	5,583	1,112	41	3·94	1·79	32·60	10·21	8·06	5·37	3·15	72·36
Madras	1882–91	7,333	748	27	3·44	·42	4·35	5·50	2·63†	1·62	2·73	28·79
	1895	8,418	746	28	1·07	·36	4·87	·12	3·20	1·90	·24	19·60
	1896	8,120	688	27	·25	—	2·83	—	2·71	3·45	—	20·81

* Excluding subsidiary jails.

† From 1886.

The prisoners of the Central Provinces and of Bombay were more unhealthy than in the previous year, the latter only very slightly so.

In 1896 the two most unhealthy administrations were, in order, the Central Provinces and Assam ; and the three most healthy were, in order, Berar, Madras, and Burma.

As compared with the decennial ratios, cholera mortality was increased only in Bombay and Berar ; dysentery and diarrhœa were nowhere simultaneously increased, nor was diarrhœa increased in any province ; dysentery was increased in the Andamans, Bombay, and especially in the Central Provinces. Mortality from respiratory diseases was increased in the North-Western Provinces and Oudh, Bombay, Berar, the Central Provinces, and Madras ; phthisis mortality rose in Burma, Assam, the North-Western Provinces and

Oudh, the Punjab, Bombay, the Central Provinces, and Madras; and the total mortality increased in Assam, the North-Western Provinces and Oudh, Bombay, Berar, and the Central Provinces.

It will be noticed in the above table that the total mortality of the Punjab jails for 1896 is less than half the corresponding decennial ratio. The contrast between the high mortality ratios of the Central Provinces, Assam, and Bombay, and the low ratios of the Punjab, Burma, and Madras is very striking. The use of prophylactic doses of quinine or cinchonidine, though more extensive than at first, is still not sufficiently general.

The Principal Medical Officer of the Andamans reports, that owing to the large number of convicts employed in building the cellular jail there have been no reclamations in recent years, and fewer men have been employed in the forest work and on unhealthy labour generally; and that this change has operated very favourably on the health of the convicts. With regard to the water-supply he writes:—

"I have frequently noticed the defects in the water-supply, more especially in the dry weather "before the monsoon rains, when nearly all the wells and many of the tanks dry up. It is difficult to "effect any radical change in a country where there are no streams, and where a rocky subsoil prevents "the sinking of deep wells. Considerable improvements have, however, been carried out for the "protection and purification of wells and tanks. A patent boiler has been supplied to all big stations "and hospitals, and the convicts are supplied with water boiled under careful supervision. The "drinking water has been boiled in the Settlement for a good many years; but the patent boiler "invented by Mr. Larymore, and used in the Bengal jails, has a great many advantages, and facilitates "supervision. Convicts do not like boiled water, and will, if they can, evade the orders on the "subject. At large stations under close supervision, like Ross, Viper, Aberdeen, Dundas Point, "and in the local jails, the orders are fairly well carried out; but in the out-stations, where the "supervision depends nearly altogether on convict petty officers, one cannot expect very much "accuracy in details."

"About half the jails in the province of Burma were in a chronic condition of over-"crowding throughout the year." The increase in the total deaths from tubercle of the lungs and respiratory diseases was doubtless influenced thereby. As the Moulmein Central Prison has been persistently unhealthy for the past ten years, the Local Government is of opinion that it should be converted into a district jail, as soon as sufficient accommodation is available elsewhere.

The conclusions arrived at by the Chief Commissioner of Assam as to the causes of the high mortality in 1895 led to the issue of orders in June 1896 restricting the employment of prisoners on extra-mural labour, and providing for the supply of dry and adequate clothing to those employed on such labour on their return to jail. In the predecessor of this report it was pointed out that other causes besides extra-mural labour were probably at work in producing the sickness, and it was suggested that the scales of diet in use were probably defective and insufficient. Steps have been taken to introduce into the larger jails the following measures, and rules are to be drawn up to make them generally applicable in all jails and lock-ups:—A more liberal scale of diet, including a large quantity of good vegetables and an extra meal in the early morning for prisoners employed extra-murally; the discontinuance of the use of new rice; and the more extended prophylactic use of iron and quinine.

The results of the preventive issue of anti-periodics in Bengal are described in paragraph 85*. Among other works for improving the supply of drinking water to the prisoners, it may be noted that the Pasteur-Chamberland filter has been installed in the jails at Motihari, Chaibassa, Bankipur, Jalpaiguri, Bogra, Dinajpur, and Rangpur. The Hazaribagh Central Prison, the "infirmary jail" of the province had a comparatively small mortality, owing to the systematic arrangements for dietary introduced and supervised by the superintendent, and to that officer's constant attention to the selection and cooking of wholesome food for the prisoners. The Bhagalpur Central and District jails had a very low death-rate, the reasons given therefore being the absence of malaria, the careful administration of prophylactic doses of cinchonidine, the great care and attention bestowed on the sick, and careful supervision in the preparation and cooking of food.

The year was a dry one in the North-Western Provinces and Oudh, and the free population suffered but little from malarial fevers. There was, however, widespread scarcity throughout the province, much more intense than in 1895, and the health of the classes from which the jail population is chiefly drawn was undermined and weakened. While the absence of rain lessened the malarial influences, it, on the other hand, led, owing to failure of the crops, to a contracted food-supply and enhanced rates, a condition of affairs which appears to have been more effective than malaria in producing deterioration in the health of the poorer classes. A large majority of the men admitted were consequently in

* Not re-printed.

bad health ; and owing to the increase of crime, the jails were more or less overcrowded. The comparatively low death-rate under these circumstances shows that every attention was paid to preserving the health of the prisoners.

In the Punjab, the favourable results of the year are ascribed to the general healthiness of the dry year, to the practice of giving a daily dose of cinchonidine to all prisoners in the autumn months, to the great pains devoted to the allotment of tasks, and the treatment and care of the prisoners by the medical officers in charge of them, and to the issue of extra clothing to the convalescents and sick in the winter months. In 20 of the Punjab jails there were no deaths from dysentery or diarrhœa ; and it may be mentioned in this connection that the issue of boiled water for drinking is now limited to the Amritsar, Lahore Female, and Dharmsala Jails.

No explanation is given of the excessive mortality in district jails in the Bombay Presidency as compared with that in central prisons. It appears that the longer the residence in district jails the higher the mortality, and that therefore prisoners confined in those district jails are unnecessarily exposed to preventable risks. This high mortality in district jails, and the prevalence of pneumonia in the jails at Ahmedabad, Hyderabad, Shikarpur, and in the Sind Gang, are deserving of attention. In consequence of its unhealthiness, proposals have been submitted for closing the Shikarpur Jail, and transferring the prisoners to Sukkur.

The prisoners admitted into the Yeotmahl Jail in Berar were nearly all in indifferent or bad health, but there was a good deal of overcrowding throughout the year ; and it appears from the Sanitary Sheet that the condition of the barracks is not satisfactory.

The scarcity that prevailed in 1895 in the Central Provinces, and led to a greatly increased mortality among the prisoners—nearly double of that in 1894—developed in 1896 into actual famine extending over the greater part of the province. The condition of the prisoners on admission was consequently worse than that described in the report for 1895, and the results are seen in the great increase in the sickness and, especially, in the mortality. The primary cause of the dysentery which was so marked a feature of the sickness and mortality of the year, was undoubtedly a low and anæmic condition, the result of chronic starvation. A so-called scorbutic form of dysentery is under such circumstances developed, and the patient, as a rule, rapidly succumbs. But the comparatively low mortality in some of the jails furnishes some ground for the suspicion that in some of the others there may have been local circumstances, which, if they did not aggravate the condition just described, at least failed to ameliorate it.

The year is stated to have been a healthy one in Madras Presidency, and the sickness generally was less than in 1895. Quinine was issued as a prophylactic in some of the jails, but not with the necessary regularity ; and the results were therefore disappointing. Measures have been taken to remedy the local defects to which the high mortality of the Rajamundry Jail was partly ascribed. The low mortality in the Trichinopoly Central Prison, which received weakly men from some other jails, could only have been attained through careful supervision and attention to every detail connected with the feeding of the prisoners, and the sanitary conditions under which they are placed.

Progress in reduction of death-rate. — The following table shows that the lustre 1892–96 was more healthy than its predecessor, and that mortality from all the causes shown, except phthisis, was reduced for the jails of India as a whole :—

Year.	Strength.	Ratio per 1,000.									
		Admissions into Hospital.	Constantly Sick.	Deaths from							
				Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
1887–91 ...	459,442	1,134	38	3·53	1·68	6·80	3·29	6·15	2·45	1·98	34·11
1892–96 ...	523,288	1,058	41	1·97	1·25	6·59	2·12	5·59	2·71	1·81	29·77
1896 ...	110,090	983	41	1·27	1·07	5·91	1·98	5·28	3·07	1·43	27·69

As the central prisons are those in which sanitary carefulness has the best chance of proving its beneficialness, a similar table is next added dealing with them :—

Year.	Strength.	Ratio per 1,000.									
		Admissions into Hospital.	Constantly Sick.	Deaths from							
				Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
1887–91 ...	192,841	985	36	4·71	1·13	5·75	3·34	5·58	2·63	1·89	32·79
1892–96 ...	234,520	940	40	1·74	·58	4·72	1·14	4·41	3·59	1·21	24·56
1896 ...	49,680	849	38	·26	·42	4·41	·95	4·21	4·11	·81	21·50

Here also the health of the second quinquennium was better than that of the first, and the ratio of mortality from each cause shown, again with the exception of phthisis, reduced. If now for the first lustrum the ratios of the central jails be compared with those of the jails of India as a whole, it will be found that the general ratios were lower in the central jails, as well as the death-rates from remittent fever, dysentery, respiratory diseases, and debility ; whereas the death-rates from cholera, diarrhœa, and phthisis were higher in the central jails. In the second five-year period all the ratios were lower in the central prisons, except the death-rate from phthisis. The general conclusion is that, except with regard to tuberculosis, the central prisons are more healthy than the jails as a whole, and more healthy than in the past ; and that this exception seems to indicate a want of sufficient fresh air for each prisoner.

Mortality of prisoners and of troops compared.—A table is, as usual, here given to compare the mortality of prisoners in 1896 with that of soldiers. Taking the death-rate of European troops as unit, the death-rate of native troops will be represented by 0·7, and the death-rate of prisoners by 1·9. The mortality of prisoners was comparatively high as regards cholera, bowel complaints, spleen diseases, anæmia and debility, respiratory diseases, and tubercle of the lungs. Only from fevers was the European soldiers' mortality highest. The enormously greater liability of the prisoners to death from bowel complaints is well shown in the table. Taking the mortality of the native troops from fevers as 1, that of the prisoners is 1·4, and that of the European troops 4·2. Taking the mortality of the native troops from bowel complaints as 1, that of the European troops is 1·2, and that of the prisoners 14·1. Taking the mortality of the European troops from respiratory diseases as 1, that of the native troops is 4·8, and that of the prisoners 6·9. While the liability of the native soldiers to die from respiratory diseases was less than that of the prisoners, yet these diseases made up a larger percentage of the total deaths among native soldiers than among prisoners. The chief cause of death among European troops was fevers, among native troops respiratory diseases, and among prisoners bowel complaints. Of course, for obvious reasons, too much must not be made of the comparison here instituted :—

Causes of Death.	Died per 1,000 of Average Strength.			Relative Liability in Percentages.				Percentage in Deaths from all causes.		
	European Troops	Native Troops.	Prisoners.	European Troops.	Native Troops.	Prisoners.	Total 100.	European Troops.	Native Troops.	Prisoners.
Cholera	·89	·69	1·27	31	24	45	100	6·0	6·7	4·6
Fevers*	6·81	1·61	2·19	64	15	21	100	45·9	15·8	7·9
Bowel complaints ...	·68	·56	7·89	7	6	86	100	4·6	5·5	28·5
Spleen diseases... ...	·01	·02	·14	6	12	82	100	·1	·2	·5
Anæmia and debility ...	·01	·18	1·43	1	11	88	100	·1	1·8	5·2
Respiratory diseases ...	·77	3·72	5·29	8	38	54	100	5·2	36·4	19·1
Tubercle of the lungs†...	·64	·65	3·07	15	15	70	100	4·3	6·4	11·1
All other causes... ...	5·03	2·77	6·41	35	19	45	100	33·8	27·2	23·1
All Causes ...	14·84	10·20	27·69	28	19	53	100	100·0	100·0	100·0

* Enteric, intermittent, remittent, and simple continued fevers. † Includes acute and chronic pneumonic phthisis.

General Population.

General remarks.

It has frequently been indicated that the figures with which this chapter deals are approximately accurate in respect of only a few provinces. Matters are, however, improving, and a retrospect is encouraging, while there are signs of further improvement in the near future.

In Bengal ten years ago, births were registered in only 45 towns,* and the birth-rate obtained was only 21·04 per thousand of their population; in 1896, births were registered throughout the province, except in a few tracts, and the millesimal rate obtained was 38·03. In Assam and Lower Burma, the birth-rates have risen from 27·55 and 22·57 per 1,000 respectively in 1886 to 33·69 and 32·27 in 1896. In the Punjab there was less room for improvement, but the 39·47 per 1,000 registered in 1886 has risen to 43 in 1896, and the percentage of male to female births, though still the highest in the country, has fallen from upwards of 115 to 110·1.

A notable advance towards improvement in the collection of vital statistics has been made in the North-Western Provinces, where an important resolution dealing with sanitation has been issued by the Local Government. This resolution, which will be found on page 141, is primarily concerned with the reconstitution of the Sanitary Board of the province, but is certain to have far-reaching effects on the advance of sanitation generally, and the quality of registration will share in the improvement.

The registration of births is peculiarly defective in towns, and, in nearly every province, the average of the urban is lower than the average of the rural birth-rates. The birth-rates in rural areas, no doubt, gain at the expense of the urban rates on account of the custom of women who have been born in the country leaving their residences in the towns and going to their parent's homes in the country when about to become mothers. But neglect to register is the principal cause of low urban rates, and it is astonishing that Local Governments should appear to acquiesce in the practical disregard of the laws which they have prescribed.

There are obvious reasons why the death-rates should be less likely to suffer from neglect than the birth-rates, and the death-rates are generally higher in the towns than in the rural circles. It is important, especially in towns, that we should know, not only how many persons have died, but that our knowledge of the diseases which have caused the deaths should be much more precise than it is. The practical utility of such information increases with the size and importance of the town, and in seaports such information in the interests of the public health and prosperity is almost indispensable. The necessary knowledge cannot be obtained without the employment of a sufficient professional agency, and this will cost money. It may be hoped that the time is not far distant when such agencies will be established.

For the present returns are useful mainly for purposes of comparison, and are based on the population totals obtained at the last census. In their reports some of the provincial Sanitary Commissioners give calculations showing the rates based on the estimated actual population. In a few provinces such calculations are useful and interesting; in others they serve only to magnify existing errors of omission.

The following table shows the monthly incidence of mortality from all causes in each province :—

Statement showing the Deaths from all causes, according to Months, in the different Provinces of India during the year 1896.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1896.	1895.
Bengal	200,365	205,831	279,982	227,612	195,891	233,100	166,607	183,902	170,143	156 233	194,405	214,759	2,428,830	34·17	31·39
Assam..	16,062	13,809	14,543	13,171	15,984	17,104	14,128	13,253	13,199	15,224	18,292	17,048	182,417	30·33	33·72
North-Western Provinces and Oudh.	130,825	113,913	127,332	129,043	144,310	120,766	111,389	131,838	140,612	144,757	126,702	141,407	1.582,894	33·32	29·13
Punjab	83,342	57,478	51,386	46.068	54.135	50,997	46,438	47,639	51,611	52,468	57,084	50,453	648,099	31·53	29·29
Central Provinces..	31,076	33,735	33.594	38,257	44.046	38.394	35,258	50,098	47.196	46,190	35,977	35,348	408,469	49·31	36·75
Berar	10,573	10,477	13,263	16,119	13,375	6,196	9,699	11,796	10,830	9,104	6,832	6,514	124,787	43·8	49·9
Lower Burma ..	8,421	7,197	6,975	7,629	8,951	3.710	11,207	10,788	10,027	8.679	9,365	9.667	106,687	23·63	22·40
Madras Presidency	57,898	48,357	49,594	45.677	51,136	48,706	56,441	59,052	59,694	59.602	60,417	79,213	675,787	20·6	19·6
Bombay	53,764	50,122	52,835	49,606	52,538	46,951	58,918	58,903	44,082	40,961	41,040	46,722	596,472	31·69	28·61
Ajmere-Merwara ..	2,007	1,932	2,293	1,711	1,193	733	770	1,096	921	869	885	911	15,321	28·25	26·95
Coorg	335	297	343	274	407	468	498	494	421	306	334	337	4,574	26·43	29·31
Mysore	5,133	5,029	5,817	5,267	5,681	5,315	5,951	5,932	5,472	6,134	6,700	6,375	68,806	14·21	13·69
TOTAL ..	604,801	547,477	637.958	530,434	586,717	577,440	517,334	574,791	554,217	540,527	552.033	609,414	6,983,143		

* The more extended registration of earlier years was limited on account of its extreme imperfection

In India as a whole in 1896 the number of deaths recorded was greater in each of the first nine months and less in October, November, and December than in 1895. A comparison with the average number of deaths recorded throughout the country, month by month, in the last five years shows that while the numbers of deaths in the first nine months of 1896 were in every instance much above the average, the numbers registered in the last three months were greatly below it.

In Bengal the year 1896 was particularly unhealthy, both on account of abnormal meteorological conditions and the consequent scarcity in many parts of the province, which led to high prices of food-grains everywhere. In Bengal towns registration is compulsory, the work being performed by the town police. Since 1892, the statistics regarding rural areas have been collected by the village watchmen and registered by them at police stations and out-posts. From all districts it is reported that magistrates and sub-divisional and police officers have been careful to look into registration while on tours of inspection. The inspectors of vaccination were employed in checking entries in registers; they examined entries relating to 204,424 births and 152,245 deaths, detecting omissions in 1·35 per cent of the former, and 1·12 per cent of the latter. Omissions were brought to the notice of the magistrate and police-officer, and the defaulters punished when the occasion required it. The number of persons fined for neglect was 1,969, and the amount realised as fines Rs. 2,857-1-0, against 2,049 and Rs. 3,153-14-0 respectively in 1895; while 408 persons were let off with a warning, against 427 in the previous year. **Bengal.**

The number of births recorded was 2,703,486, against 2,458,623 in 1895, and the birth-rate was 38·03, against 34·59 in the previous year. This rate, although still far behind the estimated provincial birth-rate of 50 per 1,000, exhibits a very satisfactory improvement in registration. Among the districts, the highest rates were recorded in Noakhali 48·98, Faridpur 47·02, and Tippera 45·66; the lowest in the 24-Parganas 25·82, Hooghly 26·87, and Burdwan 31·11. In rural areas, where the rates varied between 78·17 per 1,000 in Phulbaria, in Mymensingh, and 15·37 in Burdwan rural circle, the average was 38·64, against 26·18 in the towns. In 22 rural areas the rates were over 50, and in 63 others over 45 per 1,000. In eleven towns, as compared with only four in 1895, the rates were above 40 per 1,000. The highest rates were 50·80 recorded in Jamalpur, 47·45 in Bajitpur, and 44·43 in Madaripur; the lowest were 10·37 in Maniktola, 10·15 in Nalchiti, and 7·61 in Jhalakati, in Backergunge; although the rates in Maniktola and Jhalakati are higher than in 1895 the rate in Nalchiti is much lower, and in all these towns the rates are lower than the quinquennial averages. The proportion of male to female births was 106 to 100, the percentage of male births varying in the districts between 114 in the 24-Parganas and 103 in Noakhali; in the towns, between 157 in Jhalakati and 78 in Barisal; and in rural areas, between 133 in Asanpur (Murshidabad) and 89 in Manihari (Purnea). The largest number of births was recorded in the month of March, and the smallest number in July.

The number of deaths registered was 2,428,830, as compared with 2,231,458 in 1895, and the death-rate was 34·17 per 1,000, against 31·39 in the previous year and 30·67 the mean of the previous five years. The highest district death-rates were registered in Darjeeling 51·43, Muzaffarpur 46·70, and Backergunge 43·82; while the lowest were recorded in Singhbhum 25·55, Puri 24·88, and the Sonthal Parganas 23·76. The highest rate obtained in any rural area was 68·36 in Falakata in Jalpaiguri, and the lowest 13·40 in Netrokona in Mymensingh, the average, 34·07, being slightly lower than the average of town circles, 36·14. The towns in which the highest death-rates were recorded were Bhadreswar 58·30, Bettiah 57·46, and Kotrung in Hooghly 56·15; those in which the lowest rates were registered were Arrah 16·20, Raghunathpur 15·92, and Maniktola 15·70. One of the lowest birth-rates was registered in Maniktola, and it is partly explained by the disparity of females among the population, but the low death-rate must be explained by defective registration. Among Hindus and Muhammadans the death-rates were nearly alike, 34·54 and 34·26 per 1,000 respectively; among Buddhists and "other classes" the rates were also similar, 27·64 and 27·58, while among a population of upwards of 190,000 Christians the rate was 19·99 per 1,000.

In every month except October, November, and December the death-rates were higher than the quinquennial means, the excess being greatest in March and June. This excess is mainly due to the large number of deaths which were recorded as due to fever in these months, while cholera was particularly prevalent from March to June inclusive. On the other hand, the death-rates were lower than the average in the last quarter of the year, due to a falling off in the mortality ascribed to fever.

Infants under one year of age died at the rates of 247·76 and 198·27 per 1,000 males and females, calculated on the numbers living at the census of 1891. Boys and girls over one and under five years of age died at the rates, respectively, of 49·40 and 41·86 per 1,000. At all age periods the male death-rates were the higher, the average death-rates of males having been 36·98 per 1,000, and of females 31·38.

The number of European seamen who arrived in the Port of Calcutta was 17,053, against 18,015 in 1895, and the average daily population in 1896 was 1,124, against 1,431. The total number of deaths was 39, against 40 in the previous year, but, on account of the smaller population, the death-rate was higher, 34·69, as compared with 19·56. The average number of the native floating population is calculated to have been 25,630, and 219 deaths among them gave a death-rate of 8·54 per 1,000, against 4·79 in 1895.

Assam.

The area in which the statistics of births and deaths were collected in Assam remains the same as in previous years, namely, the Surma and Brahmaputra valleys and a few selected areas in the Hill districts; the latter, except in the case of the Khasi and Jaintia Hills, being excluded from the general statistics. In the districts of the Surma valley and in Goalpara the work of registration is carried out by paid *chaukidars;* but in Assam proper the work is performed without payment by village headmen, who are known as *gamburas*. The registers are inspected by the police and vaccination establishments, and the monthly returns of vital statistics are scrutinized in the office of the Sanitary Commissioner, who, when he detects obvious inaccuracies, brings the matter to the notice of the district officer with a view to enquiry being made. The Sanitary Commissioner was not satisfied with the inspection work carried on by the inspectors of vaccination, and in a special circular drew the attention of civil surgeons to the matter, which, however, does not seem to have received at their hands the attention its importance deserves. The quality of the work of inspection done by the police although showing signs of improvement still leaves much to be desired. Registration of vital occurrences is compulsory in twenty of the towns, but the provisions of the law seem to be generally neglected for the birth ratios in these towns are, except in four cases, below the provincial average. There were 140 persons prosecuted for neglecting to register, and 103 convictions obtained, against 192 and 142 respectively in the previous year, and the average penalty imposed was 11 annas and 3 pies.

In the selected villages in the Garo Hills the birth-rate was 37·15 per 1,000, and the death-rate 33·58, against 36·75 and 29·79 respectively registered in 1895. In Kohima, a similar improvement in registration is apparent, the birth and death rates having been 28·64 and 25·27 per 1,000, against 20·21 and 19·09 in 1895. As might be expected from the conditions under which the statistics are collected, the birth-rates are higher in the Surma valley than in the rest of the province, except Goalpara, but for some reason the difference does not seem to extend to the death-rates. The total number of births registered in the province, excluding the selected areas above mentioned, was 169,172, against 155,631 in 1895, and the birth-rate, which is the highest yet recorded, was 33·69 per 1,000, against 31·0 in that year and 30·39 the mean of the previous five years. The highest district birth-rate was 42·71 registered in Goalpara, and this was followed by 38·02 and 33·18 registered, respectively, in Sylhet and Cachar, the two districts of the Surma valley. The lowest rates were 26·36 registered in Kamrup, 25·40 in the Khasi and Jaintia Hills, and 24·57 in Nowgong. In the last named district, where the lowest rate has been registered for years past, the public health has been very bad, but the low rate must be largely due to defective registration. In the rural areas the recorded birth-rates ranged from 51·95 in Silchar to 17·72 in Mangaldai and 16·19 in the tea garden circle in Kamrup; the average was 33·83, against 27·59 in the towns. Among the latter, the highest rates were 43·95 per 1,000 registered in Dibrugarh, 40·19 in North Lakhimpur, and 37·44 in Barpeta; while the lowest rates were 17·55 in Silchar, 13·47 in Dhubri, and 11·44 in Mangaldai. The statement that the low birth-rates in towns is in a measure due to the great excess of the male population is well exemplified in Silchar and Dhubri; while the population of Mangaldai is so small that great fluctuations in the birth-rate must occur. In the province as a whole there were born 107·44 males for every hundred female infants born. The percentages in the districts varied from 111·13 in Sibsagar to 105·25 in Goalpara; in the towns the variation was very great, ranging from 146·15 in Jorhat to 58·33 in Hailakandi; while in the rural areas the variation though not so extensive was very great, from 130·53 in Dum Duma to 63·63 in the tea-garden circle in Goalpara.

The total number of deaths registered was 182,417, against 169,304 in 1895, and the death-rate, which is the highest ever registered in Assam, was 36·33 per 1,000, as compared

with 33·72 in the previous year and a quinquennial mean of 30·17. Among the districts the highest death-rates were registered in Nowgong 45·70, Goalpara 42·11, and Darrang 40·52, while the lowest were 30·72 in Cachar, 30·06 in the Khasi and Jaintia Hills, and 29·39 in Sibsagar. In Nowgong and Darrang the death-rates were, respectively, 21·13 and 13·16 per 1,000 higher than the birth-rates. In rural areas the death-rates recorded ranged from 72·07 in the tea garden circle in Goalpara to 15·23 in Lakhimpur, and the average was 36·30, slightly lower than the average death-rate in towns, which was 37·92. Among the towns the highest death-rates were recorded in Tezpur 68·06, in Dhubri 60·31, and in the small town of Mangaldai 55·79 ; while in Sylhet 26·10, Jowai 22·29, and Shillong 18·31, the lowest rates were registered. Among the various sects, by far the largest death-rate, 59·49 per 1,000, was registered among "other classes," a community numbering nearly half a million. Judging by the extreme variation in the death-rates, 225·35 to 33·84, in the adjoining districts of Darrang and Kamrup, it would appear that persons who are not identified are included among "other classes." The death-rate of Muhammadans was 36·32, of Christians 35·07, and of Hindus, who constitute about three-fifths of the population, 32·86. The largest number of deaths were recorded in the months of November and December, and the smallest numbers in April, September, and August.

Excluding the population of the Khasi and Jaintia Hills, the death-rates of infants calculated on each thousand living at the census of 1891 were among males 216·29 and among females 195·51 ; among boys and girls between one year and five years the rates were 43·38 and 42·38 per 1,000 respectively. At the age periods between 15 and 30 only were the female rates the higher ; the average death-rate having been 37·45 for males and 35·12 for females.

North-Western Provinces and Oudh.

In detailing briefly the main features of the registration of vital statistics in the North-Western Provinces and Oudh in 1896, special account must be taken of the meteorology of that and the preceding year, for in 1895, and, especially, in 1896, these conditions were abnormal.

The early cessation of the monsoon rainfall in 1895, and the failure of the winter rains, caused a contraction of about 19 per cent. of the *rabi* area ordinarily under cultivation in that tract of country in the south of the province known as Bundelkhand. Here distress, due to bad harvests of the previous three years, had been extensively prevalent, and, in consequence of this addition to their misfortunes, the people began to suffer acutely. Relief works, which soon developed on an extensive scale, were opened, and by the end of May the people occupied on these works or receiving gratuitous relief numbered nearly 264,000. Distress was not limited to Bundelkhand, for in the neighbouring district of Allahabad, in Hardoi, Pilibhit, Garhwal and Almora, relief works on a moderate scale became necessary. With the onset of the rains of 1896, however, distress in these districts ceased, and the pressure of scarcity rapidly diminished in Bundelkhand. There was a severe outbreak of cholera among the relief-workers in Banda ; and in the distressed districts the death-rates were above the average, but only 26 deaths from starvation were reported. The monsoon rain of 1896 was deficient in Bundelkhand in June, and in July the rainfall generally was in defect to a serious extent ; while in September and October the rains failed altogether. In consequence of deficient rainfall the temperature, save in June, was abnormally high—the greatest excess being noted in September and October. Except in the north of Oudh, in the Meerut Division, and in the portions of the Agra Division, protected by irrigation against drought, the crops withered, and measures to afford assistance to the people had to be undertaken. In Bundelkhand relief works were reopened ; in other districts test works were begun, which in many instances developed into regular relief works.

The total number of births recorded was 1,660,387, as compared with 1,637,235 in 1895, and the birth-rate, 35·40 per 1,000, although lower than the mean of the previous quinquennium, 36·99, was higher than the rate recorded in 1895, which was 34·90. Among the districts the highest birth-rates were reported in Etah 52·76, Bulandshahr 51·14, and Agra 49·57 ; while the lowest rates were recorded in Azamgarh 24·0, Dehra Dun 23·05, and Naini Tal 22·11. Low birth-rates were recorded in eastern districts besides Azamgarh, and are attributed, in most instances, rather to the effect of recent agricultural distress and congestion of the population than to defective registration. The birth-rates registered in rural areas ranged from 71·65 per 1,000 in Rasulpur in Muttra to 10·91 in Kotdawara in Garhwal, the average being 34·91, as compared with 39·30 in town circles. Omitting hill stations and certain other places where exceptional conditions exist, the extremes were rates of 61·41 in

Fatehpur-Sekri and 26·44 in Lalitpur. In Bareilly there was a marked improvement in registration, and the rate rose from 30·49 in 1895, and an average of 28·87 in the previous quinquennium, to 39·54. In this town, however, an assistant surgeon was specially deputed to the work of improving registration. The success achieved by him may, perhaps, prove an incentive to the authorities of some other municipalities where improvement in registration is greatly needed. The percentage of male to female births was 108·86, varying in the districts between 113·15 in Dehra Dun and 102·2 in Garhwal.

Registration was tested by revenue, civil and police officers, and members of district boards. The number of birth entries in the registers examined was 144,049, and 2·73 per cent. of omissions were detected; death entries in 130,219 cases were examined, and the percentage of omissions discovered among them was 2·37. The vaccination staff examined the entries relating to 233,027 births and 192,173 deaths, and discovered 1·34 and ·73 per cent. of omissions respectively. Regarding the checking of registers by the vaccination staff the Sanitary Commissioner makes the following observations, quoted because they are of interest in respect of objections which have been made to the use of this agency as an auxiliary in the work of registration :—

* * * * "The chaukidar who keeps the birth and death registers in a village is by far the most "useful assistant to the vaccinator. Without him and his aid it is extremely difficult for the last-"named official to obtain reliable intelligence as to what children have been born in a village and "where they live. The result is that a successful vaccinator would be the last person who would "voluntarily report an omission or mistake on the part of the chaukidar, as on the occurrence of his "next visit to this village, the chaukidar would either be absent or give little or no assistance. I have "never expected any material help, so far as returns go, from this particular checking agency, but it "does not follow that it is not useful in practice. Although no report is made of the incident, the "mistake is generally rectified on the spot by the chaukidar and the vaccinator together, and the "practical result is more accurate registration."

It is remarkable, that, in spite of the distress that was prevalent in the province, the total number of deaths, 1,562,894, was considerably less than the number of births registered. The death-rate was 33·32 per 1,000, higher, it is true, than the rate of 1895, which was 29·13, but not much higher than the quinquennial mean 32·20, and very close to the mean of the death rates of 1893 and 1894, years in which the lowest (24·10) and highest (42·51) death-rates ever recorded in the province were registered. An analysis of the district death-rates shows that in 29, generally the northern and south-western, the rate was higher than the quinquennial average, and in 19, all eastern except Etawah, below it. Seeing that to fevers a death-rate of 25·71 is ascribed, it is interesting to note how far the fever-rates influence the departure from the normal of district rates. In 32 districts the fever death-rates were higher than the average of the preceding five years, and in all cases save four, Allahabad (where the total death-rate was slightly below the average), Farukhabad, Sitapur, and Partabgarh (where the rates were above the average), the divergence from the normal of the total death-rates appears to be due to fever. In Allahabad, where the total death-rate is slightly in excess of the normal in spite of a fever death-rate which is below it, the divergence is due to an excessive mortality from small-pox, which is 4·02 per 1,000 higher than the normal rate of ·08. In Farukhabad and Sitapur, where the total death-rates were slightly below, in spite of fever death-rates above the normal, the divergencies were due to the cholera-rates being lower than ordinary. The case of Partabgarh is peculiar; the quinquennial average death-rate from fever is only 8·56, while the death-rate under "other causes" is very high—by far the highest in 1896 in any district where the fever death-rate is low. Here, also, the low death-rate was due to the comparatively small number of deaths from cholera. In 13 districts there was more, and in 35 less, cholera than usual. In all districts, except Garhwal, Naini Tal, Kheri, Gorakhpur, Azamgarh, Ghazipur, and Ballia, the small-pox death-rates were above the average. In 38 districts the deaths attributed to dysentery and diarrhœa were less numerous than usual. The highest district death-rates were 67·40, 53·56, and 53·22 per 1,000 recorded, respectively, in Jhansi, Bareilly, and Pilibhit; while the lowest were 23·48, 22·98, and 22·32 registered in Ballia, Ghazipur, and Azamgarh. In rural circles the rates ranged from 125·31 and 99·55 in Madanpur and Birdha, both in the Jhansi district, to 16·40 in Murdah in Ghazipur; the average, which was 32·59, was considerably less than the average of town circles, 39·11. In the towns, however, the death-rates were raised by the deaths of the famine-stricken who had sought refuge only to die in the poor-houses. This was the case in Lalitpur (death-rate 114·12), Hardoi (87·97), Mau Ranipur (70·65), Orai (57·23), and Jhansi (53·68); and in all these towns cholera contributed largely to the death-rates. High death-rates were recorded in Fyzabad-Ajudhya (49·51) and Cawnpore (47·43). The lowest urban death-rates recorded were 25·73 in Baragaon, 20·26 in Purwa, and 16·07 in Mubarakpur. The ratio of deaths among Muhammadans was 33·51 per 1,000, and

among Hindus 33·31 ; among "other classes" the rate was 35·17, while among the small population of Christians the rate was only 11·96.

The seasonal distribution of the mortality was abnormal. The death-rates followed the normal course, but on a higher level until May, when there was the normal fall till July, and the usual rise in August. The rise in September culminating in October began, but did not continue ; the usual fall in November took place to a lower level than usual, but, instead of the fall continuing in December, the death-rate rose. In short, the curve of the year was normal but on a higher level till May, normal in June, July, and August ; the autumn rise failed, and there was a rise, instead of a fall, in December. The Sanitary Commissioner explains the abnormalities by high temperatures, scarcity, small-pox and cholera in the early part of the year ; deficient rainfall and absence of the autumnal fever death-rate ;—the rise in December being due to the effect of scarcity. This explanation is supported by an examination of the mortuary statements. As might be expected, the death-rates of infants were high—241·16 per 1,000 for males and 228·20 for females ; boys and girls, between one and five years, died at the rates, respectively, of 57·73 and 54·98 per 1,000 ; at every age period, except 15–30, the male death-rates were the higher ; and the average death-rates were 34·68 for males and 31·86 for females, the discrepancy being due, in Dr. Thomson's opinion, to neglect in registering female deaths.

Punjab.

Details regarding the measures taken to improve the registration of vital statistics in the Punjab have been given in the reports of recent years. Improvement under present conditions can be secured only by inducing those responsible for the actual registration of births and deaths to take an interest in the work and carry it out thoroughly, and the frequent inspection of registers by tehsildars, vaccinators, and divisional inspectors of registration seems to be a promising method of stimulating this interest, provided that the inspections are thorough and that the practice in recording omissions is uniform. It seems, however, that tehsildars discover, on an average, only one omission in the registers of every five villages, the vaccinators find one omission in every two villages, while the divisional inspectors find three omissions in every village. The number of omissions detected by vaccinators in village registers varies remarkably in different districts, and the Lieutenant-Governor is doubtful whether an omission reported always refers to a single birth or a single death, or only to an error in the register. Arrangements have been made, however, to avoid mistakes of this kind. In the municipal towns, 34 persons were fined for omitting to register births, and 36 for omitting to register deaths, the average amounts of the fines varied from over Rs. 3 in some places to only one anna in others, and the attention of district magistrates has been drawn to this irregularity.

The total number of births registered in 1896 was 884,692, against 901,584 in the previous year, and the birth-rate was 43·04, slightly lower than in 1895 when it was 43·86, but considerably higher than the quinquennial mean of 39 per 1,000. Among the districts the highest rates were recorded in Gujranwala, Ferozepore, and Jhansi, 51·9, 50·8, and 49·8 per 1,000 respectively ; while the lowest were recorded in Kangra 31·0, Peshawar 30·0, and Simla 17·4. Extraordinary high birth-rates were registered in the rural areas of Dichkot, Pakhimian and Burki, due probably to errors in the numbers of the populations on which the rates were calculated, while in Kotkhai (16·8) in the Simla district, Balakot (11·6) in Hazara, and Domel (7·8) in Bannu, the rates were very low. The average recorded birth-rate in rural areas was 43·3, as compared with 40·8 in the towns. Among the latter, the highest rates were 58·1 returned from Chunian, a small town in the Lahore district, 56·4 from Sialkot, and 55·8 from Jalalpur ; the lowest rates were recorded in Buriya 20·6, Thanesar 19·1, both in the Umballa district, and Simla 16·7. The percentage of male to female births was 110·1, but there were great variations ; in the districts the percentages ranged from 136·9 in Peshawar to 106 in Kangra ; in the towns from 175·6 in Kila Didar Singh to 75·6 in Pakpattan ; and in rural areas from 200·4 in Rustam in the Peshawar district to 87·3 in Nizampur in Kohat. The smallest numbers of births were registered in April and May, and the largest numbers in October, November, and December.

The total number of deaths registered in 1896 was 648,099, against 601,972 in 1895. Owing to the deficient rainfall there was scarcity throughout the province in the latter part of the year. Timely preparations were made to prevent actual famine, and only three deaths from starvation were reported—all in the Ferozepore district. If the scarcity was severely felt, it is not apparent in the death-rate, which was only 31·53, as compared with 34,51 the average of the preceding five years. The death-rate was, however, materially higher than in 1895, also an exceptionally dry year. An examination of the mortuary returns shows that the death-rate of 1896 would have been almost as low as

that of the preceding year, 29·29, had it not been for the exceptional mortality in January and February, especially in the former month, when the death-rate was 1·67 per 1,000 in excess of the monthly average rate, which was rather less than 2·63 per 1,000 per annum. The large excess number of deaths which occurred in January are registered under the heading "fever," and were probably due to influenza, which appears to have been prevalent in the Punjab in the end of 1895 and beginning of 1896.

The highest district death-rates were recorded in Umballa 40·89, Karnal 40·37, and Kangra 40·28 per 1,000, and the lowest 24·10 in Muzaffargarh, 23·37 in Dera Ghazi Khan, and 22·85 in Gujrat. The death-rates were above the average in 12 districts, and below it in 19. The death-rates in rural areas ranged from 192 per 1,000 in Dichkot* to 5·4 in Domel, and averaged 31·2 per 1,000, as compared with 34·4 in towns. Among the latter the highest death-rates were recorded in Kaithal 48·96, Chunian 47·10, and Bhiwani 45·54, and the lowest in Shahabad (in Umballa) 25·28, Dera Ghazi Khan 25·11, and Sadhaura 23·65. Among Hindus the death-rate was 32·82 per 1,000, and among Muhammadans 30·51, the extremes being recorded among native Christians 17·31, and "other classes" 96·42. The low rate among native Christians is due to defective registration, and the high rate among "other classes" is explained by the fact that, while they number only 6,067, the deaths of persons whose religion and caste are unknown are registered under this heading. The death-rates of infants were 229·14 per 1,000 living among males, and 223·32 among females. Boys and girls, between one year and five years of age, died at the rates of 47·99 and 53·23 per 1,000 respectively. In the age-periods, from 5 to 40, the female death-rates were the higher, but over the age of 40 males had the higher rates. By far the largest number of deaths were registered in January. In February the number of deaths was considerably higher than the monthly average, and in May it was about the average, in all other months it was below; the lowest rates were recorded in April and July.

Central Provinces.

The year in the Central Provinces was one of exceptional drought; with the exception of a few showers in some of the districts in April and May, there was no rain from January to the onset of the monsoon. Although the rainfall of the monsoon was too heavy in some districts, it was on the whole favourable until the end of September, when it died away, and the fairly good rain, which fell in the third week of November, came too late to affect the prospects of the crops in the province. During the year seed was difficult to obtain on account of previous bad seasons, lands were hard to plough and germination was defective or failed altogether on account of drought, the autumn crops withered, and in large areas the want of moisture prevented the sowing of winter crops. The distress, which had been growing in various parts of the province for years, became during 1896 actual famine among the poorer classes of the population, particularly in the northern and central districts, and in Balaghat, Bhandara, and Raipur.

The deterioration of the public health, consequent on scarcity, is very apparent in the vital statistics; the birth-rate is the lowest of any in India, except Madras, where registration is extremely bad, while the death-rate is by far the highest. In the five years ending with 1894 the birth-rate in the Central Provinces was fairly constant; but in 1895 the birth-rate fell to 33·41 per 1,000, the lowest in 14 years, and in 1896 it has fallen to 31·72, or 6·67 per 1,000 lower than the quinquennial mean. The total number of births recorded was 301,427, against 317,432 in 1895 and 368,884 in 1894. Comparing the numbers of births recorded in the districts in the three years, it appears that, in the figures of 1895, there was a decrease in 16 districts, and an increase in four, namely, Nimar, Burhanpur, Betul, and Chhindwara, while in 1896, as compared with 1895, there was a decrease in 14, and an increase in six districts, namely, Nimar, Burhanpur, Saugor, Jubbulpore, Chanda, and Raipur. The provincial Sanitary Commissioner considers the increase apparent rather than real and due to improved registration, consequent on a keener interest in the condition of the people leading to greater zeal on the part of the local registering agencies.

There has been no change in the machinery for the collection of vital statistics in the province, and there was a slight falling off in the number of villages in which registers were checked by native superintendents of vaccination, from 2,801 in 1895 to 2,686. The figures obtained show, if reliance can be placed on the efficiency of the inspections, that the *kotwar's* work of registration is well done, for among 37,000 births there were less than 1 per cent. of omissions, and among 50,000 deaths less than 2 per cent. Among the districts the highest birth-rates were 44·0, 42·29, and 37·58 recorded, respectively, in Nimar, Burhanpur, and Raipur; while the lowest were 32·53, 21·88, and 21·75 recorded

* Where the population has been understated.

in Seoni, Saugor, and Damoh. In rural areas the recorded rates ranged from 51·09 in Sohela in Sambalpur to 13·33 in Khimlasa in Saugor, and the average was 31·79, or ·76 higher than in the towns. Among the latter the highest rates were recorded in Katol (59·43), a small town in the Nagpur district, Allipur (49·06) and Arvi (46·54), both small towns in Wardha; and the lowest rates were recorded in Sambalpur (16·40), and Rajim (15·20), a small town in Raipur. The percentage of males born to females in the province generally was 106·68, but in the districts the percentages varied between 113·73 in Saugor and 100·37 in Sambalpur; in town circles they ranged from 139·16 in Jubbulpore Cantonment to 73·17 in Burha in Balaghat; and in rural circles from 126·65 in Itarsi to 92·07 in Behir in Balaghat.

The total number of deaths registered was 468,469, as compared with 349,137 in 1895, and the death-rate was 49·31, as compared with 36·75 in the preceding year, and an average of 33·76 in the preceding five years. This mortality has never been approached, except in 1878, when a death-rate of 46 per 1,000 was registered. In every district in the province, except Burhanpur and Sambalpur, the death-rate exceeded the birth-rate, and in some districts the excess was enormous, *e.g.*, Damoh, where it was 66·53 per 1,000, Saugor 50·75, Mandla 45·96, and Murwara 40·49. The highest death-rates were recorded in Damoh 88·28, Mandla 73·68, and Saugor 72·63; while the lowest were recorded in Bhandara 36·64, Chanda 36·61, and Sambalpur 30·39. In rural circles the highest rate was 102·73 in Narainganj, and the lowest 21·41 in Sironcha; the average being 49·35, slightly higher than the urban average death-rate which was 48·79, but the latter rate was swollen at the expense of the former by the influx into towns of moribund immigrants from the rural areas. This was particularly the case at Damoh and Murwara, where the highest death-rates, 172·21 and 156·88, were recorded. The lowest urban rates were 22·16, 20·81, and 18·95 registered, respectively, in Hinganghat, Dhamtari, and Rajim. The death-rate among Hindus was 42·69, among Muhammadans 43·12, and among "other classes" 87·34. No explanation of the extraordinarily high death-rate among the "other classes" is given, but it may perhaps be assumed that, as in the Punjab, the deaths of the unknown are included. The greatest numbers of deaths were registered in August, September, and October, and the least in January, February, and March. The average monthly death-rate was 4·1 per 1,000 per annum, and the extreme fluctuations were recorded in January 3·27 and August 5·27. Among infants the death-rates per 1,000 living were for males 381·43, and for females 332·50; while boys and girls, between the ages of one year and five, died at the rates of 60·70 and 50·23. It is worthy of note that, as in 1895, in every age period the male death-rates were higher than the female death-rates, the average among the former being 53·55 per 1,000, against 44·95 among the latter.

Berar.

The total number of births registered in Berar was 109,013, as compared with 105,952 in 1895, and the birth-rate was 38·3 per 1,000, against 37·2 in the previous year, and a quinquenninal mean of 38·6. In three of the districts, Buldana 44·1, Akola 41·1, and Ellichpur 40·0, rates above the average were recorded, and in the remaining three, namely, Amraoti 37·9, Basim 34·5, and Wun 31·8, the rates were below the average. In rural areas the highest recorded rate was 58·3 in Kingaon Raja in Buldana, and the lowest 26·1 in Bittergaon in Basim, the average, 38·3, being slightly higher than the average in town circles, which was 38·0. In the municipal towns the average birth-rate was 37·4 per 1,000, and ranged from 47·8 in Buldana to 28·9 in Yeotmal. In the province as a whole 105·3 male infants were born for every 100 female infants; the extreme variations of the percentage were 128·7 in the town circle of Patur in Akola, and 77·4 in the town circle of Morsi in Amraoti. In the municipal towns the highest percentage was 111·4 in Amraoti City, and the lowest 93·7 in Buldana. It is worthy of note that in these towns registration is fairly efficient; in the latter, indeed, the highest birth-rate was recorded. The greatest number of births (11,784) was registered in August, and the least (6,625) in February.

The number of deaths recorded was 124,787, against 141,937 in the previous year, and the death-rate was 43·8, as compared with 49·9 in 1895, and an average of 38·8 in the five years ending with that year. In only two of the districts—Wun, where the rate was 50·5, and Amraoti, where it was 45·6—were the rates higher than the provincial average; the lowest district rates were 42·1 recorded in Akola and 38·8 in Buldana. The rates in rural areas varied from 62·0 in Panderkowra in Wun to 29·8 in Ansing in Basim, and averaged 43·8, against 44·0 in town circles. In municipal towns the average rate was 43·3 per 1,000, and ranged from 59·5 in Yeotmal to 31·8 in Ellichpur City. Of the various sects, the Muhammadans had the lowest death-rate, 39·1, the Hindus came next with 42·7; among native Christians, a very small community, 41 deaths gave a death-rate of 83·3,

and among "other classes" the high rate of 78·0 was recorded. It appears that persons of certain low castes, which are included in the census population among Hindus, are apt to be included in the mortuary returns among "other classes." The mortality of the first five months of the year was about double the average; in June and July the deaths fell to near the mean; and in August they fell below it, and so remained to the end of the year. This divergence from the normal is believed by the provincial Sanitary Commissioner to be due to the unusually high temperature which prevailed during the first half of the year and lowered the state of the public health, and the exceptionally light rainfall in the third quarter which reduced to a minimum those monsoon conditions which tend to raise the death-rate. Among infants under one year the mortality among males per 1,000 living at that age in 1891 was 273·0, and among females 233·0; while, among boys and girls between one year and five years of age, the rates were, respectively, 97·5 and 81·5. At all age periods, except those between 10 and 30, the female death-rates were the higher. The death-rates according to sexes were 45·5 for males and 42·1 for females.

Madras.

The system under which vital statistics are collected in the Madras Presidency was described in this report for 1893. Since then, no important change has been made in the agency, and after considering the question in 1896, the Government of Madras came to the conclusion that they could not afford to make any radical change in the *personnel*. Sanction was, however, accorded in September to certain changes, which will directly and indirectly further the cause of accurate registration. These were:—

"(1) Candidates for the public service and schoolboys, who were born in municipal towns in which "the compulsory system of registration has been in force for many years, should be required, after a "certain date, to produce attested extracts from birth registers.

"(2) That the number of union and municipal registrars be calculated with reference to the "population and area of the municipal towns and unions.

"(3) That printed forms (in lieu of existing loose forms) bound into books be supplied to all "registrars.

"(4) That steps be taken to punish negligence.

"(5) That special inducements be offered to all municipal servants for reporting cases of unregistered "births or deaths."

Dr. King also addressed a circular letter to all municipalities directing their attention to the importance, from the sanitary, economic, and medico-legal points of view, of insisting on prompt registration. It may be hoped that these measures will secure some improvement in registration, which continues to be backward in Madras. In 1896 the birth and death rates were lower than the rates recorded in any other province.

During the year, the births of 979,981 children were registered, equal to a birth-rate calculated on the census population of 29·9 per 1,000, as compared with 29·1 in 1895, and 27·2 the mean of the previous five years. There was an increase in 1896 in the birth-rates in 12, and a decrease in 9, of the 22 districts, as compared with 1895, while in one district, South Arcot, the rates for both years were equal. As compared, however, with the average of the previous five years, there has been an increase in all districts, except Coimbatore, Kurnool, and Trichinopoly. In Ganjam, Vizagapatam, and the Nilgiris a considerable improvement in tracts long notorious for bad registration is recorded. The highest district figures obtained were 39·5 in Chingleput, 34·3 in Bellary, and 33·9 in Kistna, while the lowest were 26·6 in Ganjam, 25·8 in Godaveri, and 22·5 in Malabar. It may be noted that the birth-rate in Ganjam is 8·4 per 1,000 above the average, that in Godaveri 3·4 above the average, while the rate in Malabar, although lower than in 1895, is 1 per 1,000 above the average. In rural areas the recorded rates ranged from 44·4 per 1,000 in Gajapatinagaram in Vizagapatam to 10·8 in the Agency tracts of the Ganjam district; and the average was 29·5, against 34·4 in the town circles. The highest rates recorded in towns were 56·9 in Vaniyambadi, which again heads the list, 50·5 in Tenkasi, and 45·9 in Periyakulam; the lowest rates were 11·3 recorded in Pithapuram, 9·9 in Samalkot, both towns in the Godaveri district, and 9·0 in Paramagudi in Madura.

The percentage of male to female births in the Presidency generally was 104·8. Curiously enough, the urban and rural percentages, 105 and 104·8, were approximately the same, although in town circles the percentage varied between 164·6 in Sendamangalam and 76·4 in Paramagudi, while in rural areas the highest was 236·3 in the Settinandal villages in Madura, and the lowest 85·1 in Cochin. The greatest numbers of births were recorded in July and August, and the least in February.

The number of deaths registered was 675,787 and the death-rate was 20·6, as compared with 19·6 in 1895, and a quinquennial mean of 20·7 per 1,000. Among the districts the highest rates were 27 and 24·7 per 1,000, recorded, respectively, in the Nilgiris and Tanjore, while the lowest were 17·1, 16·9, and 15·7 registered in Godaveri, Nellore, and Malabar, respectively. In rural areas the rates fluctuated between 33·3 in Coimbatore and 11·3 in

Kurumbaranat, the average having been 19·9 per 1,000, or about 9 per 1,000 less than the urban average, which was 29·0. The highest rates recorded in towns were 72·4 in Kilakarai, 53·8 in Vaniyambadi, and 43·0 in Coonoor, while the lowest were 10·1 in Virudupatti, 8·1 in Paramagudi, and 6·6 in Samalkot. In the Presidency town the birth-rate was 41·5 and the death-rate 38·2. The Hindus, who constitute about 90 per cent. of the population, had a death-rate of 21·0 per 1,000, the Muhammadan death-rate was 18·1, the native Christian community, numbering 766,987, had a death-rate of 15·1, while the comparatively small population of "other classes" died at the rate of 9·3. The lowest death-rate was recorded in April, and by far the highest in December, due chiefly to an enormous rise in the number of deaths from cholera in that month. The death-rate among male infants was 150·9 per 1,000, and among females 124·7, calculated on the census population of infants.

Coorg.

The number of births registered in Coorg during 1896 was 4,606, against 4,567 in the previous year, and the birth-rate was 26·62, against 26·39 in 1895, and a quinquennial mean of 21·95. The rates obtained in rural areas ranged from 33·82 in Nanjarajpatna to 20·38 in Yedenalknad, the average being 27·81, or more than 13 per 1,000 higher than the average in town circles, which was only 14·44. It is alleged that the defective birth-rate in Coorg is due to the excess of males among the population ; this is no doubt true in a measure, but the excess of males in the urban population is only a fraction per cent. higher than in the rural areas, and yet the birth-rate in the latter is nearly twice as high as it is in the former. In Mercara the birth-rate was only 7·96, as compared with 23·16 in Virajendrapet but in Mercara the proportion of females is higher than in Virajendrapet ; certainly fluctuations in the birth-rate in a small population (7,034) like that in Mercara must be expected, still, as the quinquennial average rate is only 11·57, it must be concluded that defective registration is also to blame for the small recorded birth-rates. The average percentage of male to female births was 97·68, ranging from 133·33 in Mercara to 62·50 in Somvarpet.

The total number of deaths was 4,574, against 5,073 in the previous year. The death-rate, which for the second time in the history of registration in Coorg was lower than the recorded birth-rate, was 26·43 per 1,000, against 29·31 in 1895, and 26·26 the quinquennial mean. In the rural areas the average death-rate was 25·84, varying between 29·49 in Mercara and 22·37 in Padinalknad. In town circles the average death-rate was 32·43, but this is increased at the expense of the rural rates, by the inclusion of the deaths of residents in the latter who died in the dispensaries in the towns ; for instance, in Mercara the death-rate registered was 22·75, but if the deaths of 45 coolies who died in hospital are omitted the birth-rate falls to 16·35 ; similarly, in Virajendrapet, where the highest death-rate (56·89) was registered, if the deaths of 141 coolies are deducted the rate falls to 25·18 per 1,000. Among Muhammadans the death-rate was 20·61, among Hindus 26·80, and among "other classes" 31·03. In February, April, and October the fewest deaths occurred, and in July the largest number. Among infants under one year of age, the death-rates per 1,000 living were 260·89 for males and 230·87 for females. Boys between the ages of one year and five died at the rate of 34·09 per 1.000, and girls at the rate of 30·28. In all age periods, except those between five and 30, the male death-rates were the higher.

Bombay.

In the Presidency of Bombay, including Sind, there were registered 691,847 births, against 674,304 in 1895, and the birth-rate rose from 35·83 per 1,000 in that year to 36·76, as compared with a quinquennial average of 35·41. The highest district birth-rates were obtained in the Collectorates of Ahmednagar 47·55, Khandesh 47·30, Nasik 46·94, and the lowest in Upper Sind Frontier 26·18, Thar and Parkar 25·47, and Hyderabad 18·35. In rural areas the highest rate recorded was 63·54 in Nandgaon in Nasik, and the lowest 11·02, in Tando Bago in Hyderabad, while the average was 37·76, as compared with an average of 29·61 in town circles. Among the latter, the highest rates were recorded in Vengurla in Ratnagiri (61·64), Borsad 56·26, and Sangamner in Ahmednagar 53·22, while the lowest were registered in the City of Bombay 19·35, Thana 17·18, and Nasik 17·78. In 16 municipalities rates higher than 40 per 1,000 were obtained. The percentage of male to female births was 107·92, varying in the districts between 136·23 in Upper Sind Frontier and 101·72 in Bijapur. The excess of male births registered in the districts in Sind is attributed by the local authorities to (*a*) the greater consequence attached to the birth of a male, and (*b*) to the desire to prevent female children being vaccinated. As usual, the least number of births were recorded in February, and the largest number in July.

The total number of deaths registered was 596,472, as compared with 538,540 in 1895, and the death-rate was 31·69 per 1,000, against 28·61 in the previous year, and 29·57 the mean of the previous five years. The highest district rates were recorded in the Collectorates of Nasik 43·76, Broach 39·98, and Khandesh 39·0, while in Shikarpur 21·91, Thar and Parkar 21·51, and Hyderabad 17·46, the lowest rates were registered. In rural areas death-rates ranged from 50·35 in Nandgaon to 10·41 in the rural circle of Karachi, the average being 30·92, against 37·21 in the towns. The highest urban death-rates were recorded in Ahmednagar 60·00 per 1,000, Nasik 54·90, and Godhra 51·19. In Ahmednagar, where the quinquennial mean death-rate, 53·47 per 1,000, is very high, the death-rate given under "other causes" is 32·42 per 1,000; six deaths from plague were recorded. The quinquennial mean death-rate of Nasik is 34·29, and there was an increase of upwards of 20 per 1,000 in 1896; the increase of deaths from fever seems to be the chief cause of rise; no case of plague was reported. In Godhra the increase in the death-rate, as compared with the mean, was nearly 18 per 1,000, accounted for by the prevalence of cholera and small-pox. In the City of Bombay the death-rate was 40·99, compared with 30·58 in 1895, and a quinquennial mean of 30·77. The death-rates from small-pox and cholera were more than twice the average, the death-rates from fever and dysentery and diarrhœa were higher than usual; while the recorded death-rate under "All other causes" was 25·18 per 1,000, against 19·51 in 1895, and a quinquennial mean of 19·21. There were 1,936* deaths recorded as due to plague, equal to a death-rate on the estimated population of 2·40 per 1,000. In short, the death-rate in Bombay was upwards of 10 per 1,000 above the normal; cholera, small-pox, fever, and dysentery and diarrhœa account for a little over 4 per 1,000 of the excess, while deaths registered as due to plague account for 2·40. Among the various sects the lowest death-rate, 17·14 per 1,000, was registered among "other classes," and the next lowest, 24·70, among Christians. The low death-rate among Muhammadans 24·48, as compared with the rate among Hindus 33·74, is accounted for by the fact that the former are about one-fourth as numerous as the latter in the Presidency generally, while they are nearly four times as numerous in the districts of Sind where registration is most defective. As compared with 1895, deaths registered were more numerous in the first eight months, particularly in February, and less numerous in the last four months of the year. The highest mortality occurred in July and August, and the least in October and November. Among male infants the death-rate per 1,000 living was 194·32, and among females 164·47; the corresponding figures in 1895 were 191·04 and 161·92. Among boys and girls between one and five years of age the rates were, respectively, 56·67 and 53·06 per 1,000, against 53·56 and 50·99 in 1895. There was some divergence from the normal relation of the death-rates among the sexes in the various age periods. From 5 to 10, 10 to 15, and 15 to 20 the female death-rates were the higher; from 20 to 30 and 30 to 40 the male rates were slightly, and from 40 to 50 they were considerably, the higher. Between 50 and 60 the female death-rate was the higher, after which the male rates were the higher.

Burma.

The area under registration comprises the whole of Lower Burma, except the districts of Northern Arakan, Salween, and portions of the districts of Bassien, Toungoo, and Thayetmyo, and the population concerned, as determined by the census of 1891, is 4,514,773. In Upper Burma in only four towns, Mandalay, Yamethin, Pyinmana, and Myingyan, with an aggregate population of 227,310, are vital statistics registered, but it is intended to extend the system of municipal registration adopted in Lower Burma to all the towns. Slight changes in the areas and populations under registration have been made, but not of sufficient importance to require special mention. A change, which is important, has, however, been made in the rural areas. Prior to 1896 the returns for these areas were compiled by townships, but it was found that these units were too large, while village units again were too small; it was decided to adopt the police-station area as a unit, and the rural circles accordingly now correspond to the police-station areas. In most municipalities and towns registration is carried out by headmen and elders of quarters. In some towns special paid registrars have been engaged, and in villages the work is entrusted to the headmen. The provincial Sanitary Commissioner considers that the new rules for the collection of the statistics introduced in 1897 are theoretically perfect, and anticipates marked improvements in results when they have been brought into working order throughout the province. Meanwhile, it is satisfactory to note that the improvement in the registration of vital statistics discernible in recent years has been more than

* Report of the Municipal Health Officer.

maintained, and that the birth and death ratios are the highest on record. The total number of births registered was 145,688, against 131,147 in 1895, and the ratio per thousand of the population was 32·27, as compared with 29·04 in the previous year, and 25·65 the quinquennial mean.

The highest district birth-rates were 42·84, 41·27, and 40·54 per thousand recorded, respectively, in Pegu, Sandoway, and Tavoy; while the lowest were 28·59, 28·46, and 17·91 recorded in the districts of Thaton, Amherst, and Rangoon town. The population of the last is of course urban, and the rate recorded, as in the cases of the other considerable maritime towns of Akyab (13·97) and Moulmein (24·63), was below the urban average (25·17). As the Sanitary Commissioner explains, one of the main causes in determining the low birth-rates in the larger towns is the deficiency of the females in the population. The excess of males is very great in Akyab and Rangoon. This excess is not quite so marked in Bassein and Moulmein; in the former, however, in which the proportion of males is slightly the greater, the birth-rate was 35·62, or nearly 12 per 1,000 higher than in the latter. In only nine of the 35 towns are the female populations higher than the male; these towns are all small, but in only three, Tavoy, Mergui, and Allanmyo, are the birth-rates higher than the provincial average, while in two, Ramree and Thônzé, the rates are lower than the average rate in towns. In the small populations of rural areas considerable fluctuations in the rates must be expected, but scarcely perhaps so great as is shown by a comparison of the rates recorded in Tantabin (73·96) and Kyeintali (70·33) with the rates recorded in Paingkyon (12·73) and Talaingdaung (8·02). In the province as a whole 107 boys were reported to have been born for every hundred girls, but there were great variations in the rates comparing even large district populations, the extreme percentages being 114 in Sandoway and Tavoy respectively, and 100 in Mergui.

The total number of deaths registered in 1896 was 106,687, against 101,160 in the previous year, and the death-rate, which in 1895 was 22·40 per 1,000, as compared with a quinquennial mean of 20·73, rose to 23·63. The highest district death-rates were 28·27 and 27·72 per 1,000 recorded in Pegu and Tharrawaddy, while the lowest were 17·89 and 16·76 recorded in Amherst and Mergui. The average urban death-rate was 28·34, ranging from 43·36 and 36·31 per 1,000 in Myaungmya and Rangoon respectively to 13·24 and 10·68 in Yandoon and Gyobingauk. In the rural circles, where the average death-rate was 22·93, the rates varied between 28·30 in Tharrawaddy and 15·01 in Amherst. The infant mortality was 235·9 males per 1,000 living and 169·44 females. Between the ages of one year and five years, 33·60 per 1,000 was the rate among boys, and 28·57 among girls. The male rates were higher than the female at all ages except between 20 and 40. Of the various sects, the Christians had the lowest death-rate (12·69), and the Hindus the highest (25·15), Burmese (23·97), Muhammadans (22·78), and "other classes" (19·77) occupying intermediate positions. The least mortality occurred in March, and the greatest during July, August, and September.

History of Chief Diseases.

Cholera.

In this report for the year 1894 an attempt was made to summarise the more important work which had been done, in recent years, towards the solution of the problem of the etiology of cholera.

In the conclusion it was stated that the best known observers in Europe were agreed that the comma of Koch is the principal factor, but that many difficulties remained to be explained; chief among these were immunity of persons and places, and the relationship to the microbe of cholera of the "cholera-like" vibrios found, chiefly in the autumn, in the waters of European rivers and elsewhere. The statement that cholera is caused by a particular vibrio must remain an assumption until the circumstances under which that vibrio is potent to cause cholera have been discovered. One of the most obvious first steps in this direction is the determination of the relations of the harmless vibrios found in river water, and much research has been devoted to this end. But as experience has grown and knowledge has deepened the explanation of difficulties appears to get further off than ever. One by one the tests which were believed to differentiate the comma bacillus of Koch have been found unreliable, until, in difficult cases, only one remains, the reaction with cholera-serum. Regarding even this test, Dunbar,* who is confident of its scientific value, says that it would be well not to affirm that all vibrios

* *Zeitschrift für Hygiene und Infectionskrankheiten*, Vol. XXI., p. 303.

which give a positive reaction are cholera vibrios. On the other hand, he states that one may be certain that any vibrios which fail to give a positive reaction with efficient cholera-serum are not the genuine vibrios of cholera.

It would appear, however, that the distinction of "cholera-like" vibrios from the vibrios of Koch is not generally difficult for the experienced observer; and, in Germany, the presence of real vibrios in the absence of cholera is said to be very rare. This does not seem to be the case in this country, and, in England, Dr. Klein has frequently isolated genuine vibrios derived from cases where no connection with Asiatic cholera could be traced. The recent work done by Dr. Klein, although not yet sufficiently advanced to allow of an appreciation of its full significance, seems to be by far the most important contribution made of late years to the elucidation of the cholera problem.

During the time of the recrudescence of cholera in Europe in 1893, attacks of cholera or resembling cholera occurred in England, and from 53 reported cases of this kind material was submitted to Dr. Klein for examination. In his report* Dr. Thorne Thorne classified these cases as follows:—

(*a*) Fifteen, in which, in the stools or bowel-contents, flakes were found containing commas, not only in pure culture, but distributed in the "fish-in-stream" like arrangement said by Koch to be absolutely characteristic of the vibrios of cholera.

(*b*) Fifteen, in which, although examination of the stools or bowel-contents gave equivocal or negative results, cultural tests demonstrated the presence of Koch's vibrio.

(*c*) Twenty-three, in which the presence of the vibrio could not be demonstrated by any means at Dr. Klein's disposal.

The bacteriological examinations were completed in nearly all instances before the receipt of the clinical histories of the illnesses. When the latter were compared with the results of the former, it was found that the 30 cases (*a* and *b*) in which vibrios had been demonstrated presented, almost without exception, the clinical features of Asiatic cholera, and all but two were fatal. In only a minority of instances, however, had the persons attacked been residing in localities where unmistakeable cholera had already manifested its presence, or where it made its appearance soon afterwards. In more than half of the cases, indeed, the circumstances were such that, but for the bacteriological evidence, the seizures would have been considered to be cholera *nostras*. Of the remaining 23 cases (*c*), in six the materials submitted were not in a state to admit of the detection of vibrios even if present. Little more half the 23 attacks proved fatal, and, when fatal results did ensue, death was often greatly delayed. In a few of the attacks, however, the disease was not to be distinguished from Asiatic cholera, and the antecedents were such as to tend to the presumption that they were cases of that disease. Further, Dr. Klein found the behaviour in culture media of some of the vibrios which he succeeded in cultivating to differ from the behaviour of Koch's vibrio, and was disposed, therefore, to conclude that several microbes might be included under the term "Koch's vibrio."

Commas, then, were found in cases which, clinically and from their antecedent circumstances, seemed to justify the exclusion of cholera from the diagnoses; and cases occurred in which, clinically and otherwise, the presence of cholera was indicated, but the commas were absent. Moreover, there was variation among the vibrios which were insolated. In view of these facts, the Local Government Board directed that further examination should be made into the occurrence of cases of suspected cholera.

In 1894 and 1895, Dr. Klein examined materials from 29 such cases.† The localities where the attacks occurred were widely separated, but in some of them cholera had been present in 1893. Several of the seizures were clinically indistinguishable from genuine cholera, and, in some instances, the localities and circumstances were suggestive of their relation to cases of that disease. In no single instance, however, were Koch's vibrios found after the most diligent search. But other microbes were present in great abundance, as it were in place of the vibrios. These microbes were the *bacillus coli* and the *proteus vulgaris*. An analysis of 28 cases—for of one no details are given—shows that in 16 the *bacillus coli* was isolated alone in pure culture, in five the *proteus* alone, while in seven both microbes were present. In three of the seven the *bacillus coli* predominated, in two the *proteus*, and in two the predominating microbe is not stated. Not only did

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* Reports and Papers on cholera in England in 1893; with an Introduction by the Medical Officer of the Local Government Board.

† Twenty-fifth Annual Report of the Local Government Board, 1895-96. Supplement containing the Report of the Medical Officer, Appendix B, No. 1.

these bacteria seem to replace the vibrios of Koch, but, in some instances, the *bacillus coli* was distributed in the epithelial flakes in the "fish-in-stream" arrangement formerly believed peculiar to Koch's vibrio and absolutely diagnostic of cholera. The cases in which this arrangement was found were chiefly those in which Asiatic cholera was most closely simulated, not only clinically but in the naked eye appearances on *post-mortem* examination, and were mainly derived from localities where cholera had been present in 1893. "In a word," writes Dr. Thorne Thorne, "they differed from that disease solely in the circumstance that the "predominant micro-organism, which exhibited in the intestinal flakes the 'fish-in-stream' "arrangement, was not Koch's vibrio but *bacillus coli*." It may be noted that in one instance the *proteus* was present in streaks and lines in the hyaline matrix of the intestinal flakes.

Whatever may be the significance of these observations, researches, so far as they have gone, seem to indicate that, when genuine cholera exists in the neighbouring European countries, cases of disease, clinically resembling Asiatic cholera, which occur in England, are, generally, distinguished by the presence of vibrios, while, if there is no genuine cholera in the neighbourhood, vibrios are replaced by other microbes in similar cases of disease.

In England the procedure adopted on the occurrence of cholera or cholera *nostras* differs according to the variety of microbes detected. If vibrios are discovered in the stools or bowel-contents in a suspicious case, Asiatic cholera is administratively held to be present, and extreme measures of precaution are taken. In India we have long been familiar with the necessity for treating sporadic cases differently from epidemic outbreaks; but the presence of "administrative" cholera is decided, not on bacteriological, but on clinical and epidemiological evidence. When a suspicious case of illness occurs among a body of men, the building in which the case occurred is evacuated and the men are segregated; if a second case occurs among the same body of men, they are again moved; and, if a third seizure takes place within a week of the first, the men are moved from the station to a preparatory camp. The procedure in India has been blamed in some quarters on what seems to be very insufficient grounds. It must be admitted, if vibrios are alone the potent factors in the causation of epidemic cholera, that the European method of determining, by a bacteriological examination, whether genuine cholera is, or is not, present, has the appearance, not only of being more scientific, but of being more reliable than the Indian method. But it must be remembered that all the conditions are essentially different. In Europe it seems that the presence of "cholera-like" vibrios in water is not common, except at certain seasons of the year, while the presence of vibrios in the intestines, in the absence of cholera, is very rare. In India, it would appear, that vibrios are very common in water,* while sufficient facts have not yet been recorded to enable us to say whether they are frequent or infrequent inhabitants of the human intestine, or whether they or other microbes are generally present in sporadic cases of clinical cholera.

Single cases of cholera form no inconsiderable proportion of the total number of attacks among troops and in prisons in India, and it is evident, if vibrios are invariably present, that it would not be an advantage to take the extreme measures of precaution necessary on the occurrence of epidemic cholera, whenever they are found. Again, the functions of the administration in Great Britain and India are different. Great Britain has, happily, for many years been exempt from severe epidemic outbreaks of cholera, and the sanitary condition of most of the towns is now sufficiently good to justify the hope that the prompt adoption of measures of precaution will check an outbreak. In India no large part of the country is free from cholera for any great length of time; in the greater part of the country cholera is an annual visitant, and in some places it is continually present. Unhappily the time seems yet far distant when it will be possible to prevent epidemic cholera occurring in Indian towns, and, as yet, the only action which the administration can undertake with a reasonable certainty of success is the prevention of serious mortality when cholera breaks out in a body of men under their control.

Until we know exactly what the cause of cholera is, it is clearly impossible to remove that cause from a body of men; but we can remove the body of men from the cause. And movement, in India at any rate, is the one sovereign remedy; it rarely fails, and when it does fail, the failure can, generally, be easily traced to the neglect of reasonable precautions.

* An enquiry into the relative frequency of vibrios in Indian waters, with reference to the prevalence of cholera in different parts of India, would be of great interest. Are vibrios always present in endemic areas and absent from, say, the Punjab, except in cholera seasons?

Experiments in India.—Two experiments in cholera prophylaxis are being carried out on a great scale in this country. One, suggested by Mr. Hankin, aims at the destruction of the cause of cholera as near to its source as possible, the other, devised by M. Haffkine, is intended to render the human system immune to the disease, by rendering it capable of destroying the cause when it reaches the body. The first method depends on the belief that cholera is commonly, if not always, water-borne ; the second, on the belief that a particular vibrio is the principal factor in the disease.

Mr. Hankin's method—Mr. Hankin recommends that, on the outbreak of cholera, the sources of the water-supply of the people living in the neighbourhood should be treated as far as possible with some chemical disinfectant, preferably permanganate of potassium. There seems to be some misconception abroad as to Mr. Hankin's suggestion, and he has been charged with bringing forward as a discovery a well-known chemical fact. It is quite true that the use of alum to clear polluted waters has been known for a very long time, and that, so far back as 1859, manganates and permanganates were shown by Hofmann to be valuable disinfecting agents, while their general application for such purposes was made popular by Mr. Condy. But Mr. Hankin's suggestion is the application of the well-known properties of chemical agents to the prevention of cholera by endeavouring to destroy the cause of the disease near its source, and, as such, seems to be absolutely new. What remains to be proved is the effect of the measure ; and there are obviously great difficulties to be encountered in proving whether it is efficacious or not. On the one hand, epidemics of cholera are prone to sudden cessation, from unknown causes, and, on the other, when the disinfectant is employed, sources of infection may remain, either overlooked altogether or insufficiently disinfected. Epidemics in villages cannot be arranged, and it must be a long time before the number of accumulated facts is large enough to establish conclusions. As yet only opinions are available, and, so far as they are of any value, they are distinctly in favour of the procedure, though the evidence, it must be confessed, is conflicting.

Anti-cholera inoculations.—M. Haffkine's inoculations were carried on in 1896, in Bengal, at first under M. Haffkine's own superintendence, and subsequently by Surgeon-Captain J. C. Vaughan and two Assistant Surgeons, acting under his general supervision. The total number of persons inoculated in Bengal, exclusive of Calcutta and its suburbs, was 4,413, most of whom were coolie emigrants proceeding to Assam.

The distribution of cholera in India.—The total number of deaths recorded as due to cholera throughout India and Burma in 1896 was 471,779, a mortality greatly in excess of that of the preceding year, when 313,420 deaths were recorded, but considerably lower than in 1894, when the number was 521,975. Except in Assam, Burma, Ajmere-Merwara, and Mysore, the numbers of cholera deaths in all the provinces were higher than in 1895, and it may be noted that, in spite of the lower aggregate number of deaths, the mortality was higher than it was in 1894 in all provinces, except Bengal, the North-Western Provinces and Oudh, Hyderabad, and Burma.

In the following statement the number of deaths registered in the various provinces in 1896 are compared with the numbers registered in each of the preceding 19 years :—

Statement shewing the deaths from Cholera in the different Provinces in India from 1877 *to* 1896.

YEAR.	Bengal.*	Assam.	N.-W. P. and Oudh.	Punjab.	Central Provinces.	Berar.	Rajputana.	Central India.	Bombay.	Hyderabad.	Madras.	Mysore.	Coorg.	Lower Burma.	Ajmere-Merwara.
1877	155,305	11,377	31,770	29	3,418	842	60	926	57,228	7,414	357,430	2,902	‡	7,276	11
1878	95,192	6,732	22,221	215	40,985	34,306	2,393	8,047	46,743	6,696	47,167	723	49	6,759	210
1879	130,363	17,415	35,892	26,135	27,575	223	918	2,734	6,937	6	13,296	14	—	1,828	120
1880	39,643	2,803	71,546	274	330	1	—	299	684	—	613	25	—	2,638	3
1881	79,180	5,010	25,865	5,207	9,140	3,404	197	581	16,694	1,721	9,446	25	3	5,239	16
1882	182,352	21,055	89,372	39	11,932	3,573	1,327	1,562	7,904	150	23,604	893	31	7,177	289
1883	90,439	14,908	18,360	190	16,235	27,397	797	1,740	37,954	1,947	36,284	124	—	2,185	87
1884	134,421	22,276	30,143	614	149	87	1,297	1,018	13,804	2,479	75,476	330	—	5,515	227
1885	173,767	7,753	63,457	1,936	21,838	3,683	1,615	4,624	37,287	1,387	58,109	2,677	—	7,685	100
1886	118,368	20,188	34,565	12	16,679	976	173	290	167	499	12,417	10	—	4,027	765
1887	172,578	7,941	200,628	8,804	12,576	14,396	2,612	8,868	25,711	2,831	28,359	832	3	2,649	384
1888	111,391	9,693	18,704	14,938	921	305	32	191	36,500†	2,057	58,677	1,015	2	15,982	13

* Excluding Calcutta from 1877 to 1892.

† Including four deaths, the monthly distribution of which is not known

‡ Statistics not available.

Statement shewing the Deaths from Cholera in the different Provinces, &c.—continued.

YEAR.	Bengal	Assam.	N.-W. P. and Oudh.	Punjab.	Central Provinces.	Berar.	Rajputana.	Central India.	Bombay.	Hyderabad.	Madras.	Mysore.	Coorg.	Lower Burma.	Ajmere-Merwara.
1889	171,103	18,288	48,494	2,838	52,588	10,925	6,923	3,344	32,431	1,128	76,020	1,590	9	3,240	55
1890	145,885	15,396	80,295	3,401	4,787	847	2,746	3,132	3,259	—	35,288	1,326	5	1,076	408
1891	229,575	23,882	169,013	10,107	21,312	7,958	2,946	13,474	17,850	3,102	98,773	1,204	7	2,400	532
1892	259,398	21,552	194,886	75,959	39,972	2,030	26,760	8,384	42,900	53	79,033	5,497	58	6,208	2,352
1893	126,976	21,849	12,154	639	557	1,188	314	127	18,853	165	32,209	680	9	2,393	3
1894	236,150	13,497	178,079	113	7,043	3,452	2	5,210	33,588	1,862	42,289	328	8	7,428	—
1895	177,087	18,962	51,562	549	15,506	11,919	1,049	6,043	8,890	467	21,172	2,234	—	5,150	289
1896	226,824	17,042	69,147	5,146	52,985	12,264	3,797	15,766	35,404	525	47,847	2,100	49	2,959	12

The following table shews the seasonal distribution of fatal cases in the different provinces. The highest mortality, it will be observed, occurred in the months of May and June, and the lowest in January, February, and November.

Statement shewing the deaths from Cholera registered in the different Provinces, by Months, during the year 1896.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1896.	1895.
Bengal	12,259	12,217	35,142	42,846	38,318	38,099	14,001	13,505	6,896	2,782	3,707	7,052	226,824	3·19	2·49
Assam	1,719	1,171	1,642	1,652	1,508	1,455	350	318	506	1,036	3,044	2,641	17,042	3·39	3·78
North-Western Provinces and Oudh.	145	179	1,145	7,653	12,480	9,380	5,138	9,366	12,926	9,169	1,340	226	69,147	1·47	1·10
Punjab	—	—	—	1	1,245	1,206	1,037	845	547	231	33	1	5,146	0·25	0·03
Central Provinces ..	29	829	2,879	8,407	12,935	14,000	6,384	4,931	1,816	424	143	208	52,985	5·58	1·63
Berar	38	148	1,055	2,869	2,310	653	2,304	1,600	844	321	112	10	12,264	4·31	4·19
Lower Burma ..	191	75	71	288	419	439	598	295	162	168	115	138	2,959	0·66	1·14
Madras Presidency	449	381	274	322	1,368	2,699	3,618	4,065	5,898	4,813	5,961	17,999	47 847	1·46	0·63
Bombay „	144	164	663	2,942	5,908	5,483	9,772	6,424	1,822	584	587	911	35,404	1·88	0·47
Ajmere-Merwara ..	—	—	—	2	1	4	1	4	—	—	—	—	12	0·02	0·53
Coorg	—	—	—	—	—	—	11	27	6	—	—	5	49	0·28	—
Mysore	13	—	2	3	75	173	185	221	99	342	464	523	2,100	0·43	0·48
TOTAL ..	14,987	15,164	42,873	66,985	76,567	73,591	43,399	41,601	31,522	19,870	15,506	29,714	471,779	2·17	1·43

In the next statement the millesimal death-rates in the different provinces in 1896 are compared with the averages of the preceding five-year period; the average urban is compared with the average rural mortality; the maximal rates recorded in town and country circles are given; and the months of the greatest prevalence of the disease in each province, as indicated by recorded deaths, are shewn :—

PROVINCE.	Mortality in 1896.	Mean mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in any one rural circle.	Maximum mortality in any one town.	Month of maximum prevalence.
Bengal	3·19	2·91	5·14	3·09	12·2	24·02	23·58	April.
Assam	3·39	3·97	5·50	3·35	17·6	7·74	26·18	November.
North-Western Provinces and Oudh.	1·47	2·58	1·58	1·46	6·5	33·90	51·22	September.
Punjab	0·25	0·85	0·14	0·26	1·8	11·5	3·63	May.
Central Provinces ...	5·58	1·78	4·61	5·67	16·1	29·10	41·05	June.
Berar	4·3	1·8	5·3	4·2	12·4	17·4	29·2	April.
Lower Burma ...	0·66	1·04	0·40	0·69	7·5	5·50	8·88	July.
Madras	1·5	1·6	2·3	1·4	9·8	13·9	60·6	December.
Bombay	1·88	1·30	1·71	1·90	10·5	14·74	13·06	July.
Ajmere-Merwara ...	0·02	1·17	0·06	0·01	0·5	0·13	0·23	June & August.

The number of deaths registered as due to cholera in Bengal in 1896 was 226,824, equal to a death-rate from that cause of 3·19 per 1,000, as compared with 2·49 in 1895, and 2·91 the quinquennial mean. The increase is ascribed, generally, to the concentration on account of the deficient rainfall of the bad water-supply of the people. The cholera death-rates were highest in the districts of Muzaffarpur (8·78), Balasore (7·72), Howrah (6·73), Nadia (6·52), Darbhanga (6·24), 24-Parganas (5·83), Khulna (5·72), and in the City of Calcutta (5·06). In all of these districts, except Muzaffarpur, the prevalence of the disease was ascribed to deficient and polluted water-supplies. In Muzaffarpur, however, the disease was much less prevalent in the south and centre of the district, where the people are described as having recourse for drinking purposes to stagnant puddles, than in the north of the district, where the water-supply was comparatively abundant. The Sanitary Commissioner accounts for these curious facts as follows :—

"That" (*i.e.*, greater severity where water most plentiful) "may be the cause of its greater virulence "there in a year in which there was not enough rain to flush and purify the tanks and wells. It "may be imagined that cholera once started in such a locality, and the habits of the people being "what they are, all the water supply would soon become polluted or impregnated with the cholera "germs, and then it is easy to account for the rapid spread and virulence of the disease."

This explanation is quoted, apparently with approval, in the resolution by the Local Government, but it is difficult to follow. The disease was prevelant in every registration circle in the district, and if we are to accept a deficient polluted water-supply as the cause of cholera prevalence in the other districts, the explanation given does not render it apparent why it should be regarded as a comparative protection in part of Muzaffarpur. It may, however, be noted that the localities named in which the cholera death-rates were highest are, except Darbhanga, in Bengal proper and Orissa, and that, with the exception of Darbhanga, the greatest prevalence of cholera in them occurred before the end of May. In Darbhanga the disease was most prevalent from April till July ; in Muzaffarpur, from April to September.

Not only was the mortality of the year very high, but the disease was very widely spread, and only 34 of the 701 registration areas were entirely free from it. The rural mortality was 3·09 per 1,000, much lower than the urban, which was 5·14. In only five towns, Darjeeling, Kurseong, Kishanganj, Lohardagga, and Daltonganj, was no death registered, although in a good many there was only a single death. In the province as a whole the disease was most severe in April, May, and June. In Bengal proper and in Orissa, the months of greatest prevalence were March and April ; in Bihar, May and June ; and Chota Nagpur, where cholera was comparatively less prevalent than elsewhere, May, June, and July. The periods of least prevalence in the province, as a whole, were October and November ; in Bengal proper, August and September ; in Bihar, October, November, and December ; in Orissa, October and November ; and in Chota Nagpur, October, November, and December.

The number of deaths ascribed to cholera in Assam in 1896 was 17,042, equal to a death-rate of 3·39 per 1,000, against 3·78 in 1895, and 3·97 the average of the previous five years. In the Surma Valley the disease was much more prevalent than in 1895, but in every district of the Brahmaputra Valley, except Nowgong, the death-rates were lower. In Nowgong, where the death-rate in 1895 had fallen to the comparatively low figure of ·91 per 1,000, it rose in 1896 to 4·22. Following Nowgong, the districts in which the highest rates were recorded were Sylhet 3·86 and Lakhimpur 3·67 ; while in Kamrup, where the highest rate was registered in 1895, the mortality fell to 1·49, the lowest in the province. The average cholera death-rate in rural areas was 3·35, much lower than the towns, in which the average was 5·50. The excessive urban rate was due to the deaths of coolies landed at the depots at Tezpur (where the enormous cholera death-rate of 26·18 was registered), Dhubri (22·38), Silchar (14·09), and Gauhati (9·18). If these deaths, aggregating 302, are excluded the urban death-rate from cholera is reduced to 2·85, considerably less than the provincial average. Only three small towns escaped altogether, Mangaldai, where in 1895 16 deaths yielded a cholera death-rate of 22·89, Jorhat, and North Lakhimpur.

In the tea-gardens the estimated mortality was 4·64 per thousand. The facts that the sanitation of the gardens is generally much better than in the villages, and that the incidence of cholera is more severe in the latter than in the former, lend the appearance of probability to the belief, frequently expressed by civil surgeons, that the mortality from cholera in tea-gardens is due to the introduction into them of the disease by immigrant coolies. It is pointed out in the resolution of the local adminstration that the cholera death-rate in tea-gardens appears much higher than it really is, as it is calculated on the census population of 1891, and since then the garden population has increased by nearly

30 per cent. Calculated on the actual population, the cholera death-rate in the gardens is about 3·58 per thousand. It is said that the majority of deaths from cholera in the gardens occur during the height of the immigration season, whereas the greatest prevalence of the disease in the province generally does not shew this coincidence. It would be of interest—and might furnish data on which to base preventive measures—if details were obtained shewing whether cholera is confined to new comers, who presumably contract the disease *en route* to the gardens, or whether, and in what gardens, the disease spreads among the resident coolies. In connection with the mortality of coolies on their journey from India to Assam, Surgeon-Major Campbell was deputed near the end of the year to enquire into the conditions of the journey. He has submitted an interesting report. Effect has already been given to some of his suggestions, and others, from which much benefit may be expected, will be adopted.

As usual, cholera was present in every district of the Brahmaputra and Surma Valleys, and in every month of the year. In the province as a whole, the maximum prevalence of the disease was in November and December, due to a great and sudden increase in the Surma Valley in the former month. In the Surma Valley the months of greatest prevalence were November, December, and January ; in the Brahmaputra Valley, April, May, and June.

The total number of deaths from cholera in the North-Western Provinces and Oudh was 69,147, and the death-rate was 1·47 per 1,000. This, although higher than in 1895, when the rate was 1·10, is considerably lower than the quinquennial mean of 2·58. The death-rates were highest in Jhansi (8·95), Banda (5·88), Bareilly (4·15), and Naini Tal (4·10). No district escaped entirely, but only 13 deaths were recorded in Budaun, 11 in Etawah, and two in Mainpuri. The rural death-rate was 1·46, as compared with 1·58 in the towns. Among the larger towns, Jhansi (7·30), Aligarh (4·54), Ghazipur (4·22), Muttra (3·96), Benares (3·02), Fyzabad-Ajudhia (2·81), and Jaunpur (2·40) suffered greatly. The disease was very severe in some of the smaller towns, among them Lalitpur (15·86), Sahtawar (11·72), and Shahabad (11·16). There was little cholera in the provinces in January and February, but there was a rise in the number of deaths in March, and a great increase in the mortality in April. In May the number of deaths reached 12,480, due principally to a very severe outbreak in Banda. In June there was a decline, and in July this was more than maintained. In August the number of deaths again increased, until the maximum of 12,926 was reached in September, after which the number fell off, and only 226 were recorded in December. Regarding the epidemic in Banda Dr. Thomson writes :—

> " The most violent outbreak was that in Banda. It broke out with great severity on relief works " and the district was visited and reported on by both Doctor Hutcheson (who had temporarily " returned to these provinces) and myself. High as the recorded mortality is, it probably falls short " of the truth, for great numbers of people died *en route* to their homes, and of these no statistics " could be obtained. The frightened people adopted a procedure which was probably the best under " the circumstances, and ran away from the infected areas. Any one who has seen how cholera can " spread and destroy in such a community will understand how little can be done in practice to stay " the disease when once it has thoroughly seized on the people. The water-supply is generally the " most active agent in the dissemination of the disease. In Banda the supply was carefully protected " as far as possible, but water was scanty and the wells were few.
>
> " The outbreak, though so violent, did not last long. The deaths rose from 67 in April to 3,037 in " May, declined to 989 in June, and sank to 45 in July.
>
> " The history of this outbreak, and termination appears to indicate that, in the event of cholera " appearing on large relief works, the best procedure is to immediately quit the infected locality and " to break up the gangs into as small and manageable units as is possible, and consistent with organiza- " tion and discipline. The water-supply must be most rigorously guarded—search parties going in " front of the moving gangs to select and protect the wells."

There was no outbreak of epidemic disease at the Hardwar, Dadri or *Magh mélas*.

In 1896 the total number of deaths registered as due to cholera in the Punjab was 5,146, equal to a death-rate of ·25 per 1,000 of the population, as compared with ·03 in 1895, and ·85, the mean of the preceding five years. Although the disease spared only nine of the 31 districts, it was severe only in Rawalpindi, where the death-rate reached 2·81 per 1000 ; the next highest rates having been ·77 in Kangra and ·73 in Dera Ghazi Khan. The distribution of the earliest reported fatal cases is interesting. The province was free from the disease until the 14th of April, when a fatal case occurred in the district of Ludhiana. This was an isolated case, for no other death was reported in the district until June, when 14 occurred. On the 1st of May a fatal case was reported in the rural circle of Khanpur in the extreme northern district of Hazara ; on the 3rd May a death was reported in Tarn Taran in Amritsar, and on the 5th May another case terminated fatally in Ghazi in Hazara.

The next three first fatal cases occurred in the extreme south-east of the province—on the 9th May in Butana in Karnal ; on the 10th in Gohana in Rohtak ; and on the 11th in Hodal in Gurgaon. On the 12th May a fatal case was reported in Sirhali Kalan, a rural circle in Amritsar, and on the 13th a death was reported from the rural circle of Rawalpindi. Between the 13th and the 18th deaths occurred in 18 registration circles in the Rawalpindi district ; on the 27th May there was a death in the town of Hazro ; and on the 6th June, in the rural area of Pindigheb. Only three circles of registration in the Rawalpindi district escaped, namely, the town circles of Pindigheb and Attock, and the rural circle of Makhad. The spread of the disease is ascribed by Dr. Roe to an outbreak at the Nurpur fair, a religious assemblage at a place about eight or nine miles from the town of Rawalpindi. The fair began about the 8th of May ; cholera broke out severely on the 12th, and, as we have seen above, fatal cases occurred throughout the district between the 13th and 18th of May.

The average mortality in rural areas was ·26 per 1,000, nearly twice as high as the ratio in towns, which was ·14. The only town that suffered severely was Rawalpindi, where 3·63 per thousand of the population died of cholera ; the next highest ratios having been ·52 per 1,000 recorded in Peshawar, and ·36 registered, respectively, in the towns of Rewari and Palwal, in the district of Gurgaon. Seasonally, the disease reached its maximum of 1,245 deaths in May, and there was but little diminution until August, when the number of deaths fell to 845. After this the number of deaths declined steadily to 547 in September, 231 in October, 33 in November, and 1, an isolated case in Delhi, in December.

The number of deaths ascribed to cholera in the Central Provinces in 1896 was 52,985, equal to a death-rate of 5·58 per 1,000, as compared with 1·63 in 1895, and 1·78 the quinquennial mean. This enormous death-rate has been exceeded only in 1869, when the rate computed was 10·50 per 1,000, and in 1889, when the death-rate was 5·96. Cholera was present in every district in the province ; the death-rates ranging from 15·75 in Mandla to ·68 in Burhanpur. In twelve of the twenty districts the rates were lower than the provincial average, and in five, Narsinghpur, Hoshangabad, Nimar, Burhanpur, and Betul, they were lower than the average in these districts during the preceding five years. In five of the districts, Mandla (15·74), Bilaspur (10·99), Damoh (9·57), Seoni (9·48), and Raipur (9·00), the millesimal death-rates were nine or more. In Mandla there were 5,344 deaths, and the disease lasted from the middle of March until October. The spread of cholera is said to have been facilitated by the limited water-supply, while the low general health of the people, the poorer classes of whom were existing on roots and forest herbs, rendered them an easy prey. In Bilaspur it is stated that there is clear evidence of cholera having been imported by pilgrims. The disease appeared in three different places almost simultaneously, namely, the village of Mahwadi, Bilaspur town, and Baloda. The first cases were those of three coolies who returned from the *Magh méla* at Allahabad to the village of Mahwadi in the Janjir circle on the 31st January and died the same day. In Bilaspur town three tea-garden coolies of a batch of twelve, residing in the jail compound, died of cholera on the 1st of February. In the Baloda circle the first case is said to have occurred on the 4th February, in the person of a woman who had just returned from the *Magh méla*. On the 4th February, also, cholera broke out in the towns of Mungeli and Ratanpur, places 35 miles apart, the former in the west and the latter in the north of the district. The first victims, in both cases, were " residents who had recently been absent " from their homes. On the day of the outbreak, however, and for several days previously, " many pilgrims returning from Allahabad had passed through Mungeli and Ratanpur." Dr. Hutcheson guardedly endorses the theory of importation from Allahabad in the following terms :—

" The concurrence of the outbreak at Mungeli and Ratanpur with the return of these persons who " halted at both these places would lead one to think that it was more than a mere coincidence. With " regard to the garden coolies, many of them coming to Bilaspur had travelled by the Kutni Branch " of the Bengal-Nagpur Railway, that is, by the same route by which the returning pilgrims travelled, " and among whom at the time cholera was prevalent. Both coolies and pilgrims must have halted " for some time at Kutni, and the water-supply of this place is obtained from a large open masonry " well, some 20 yards from the station. It is quite possible that the first outbreak of cholera among " the coolies was caused by ' contact or communication with the pilgrims.' "

Now, while there is no reason to doubt that the first sufferers were pilgrims or persons who had been in contact with them, it is difficult to accept the theory that they contracted cholera at the *Magh méla*, for, as we have seen, there was no outbreak at that festival ; indeed, there were only two deaths in the Allahabad district in January (the earlier on the 29th), and only 39 during February. If Kutni was the centre of dissemination, cases

should have occurred in the Murwara district in which it is situated simultaneously with the outbreak in Bilaspur, but the first fatal case in Murwara was reported on the 14th February, nearly a fortnight after the occurrence in Bilaspur.

In Damoh the severity of the disease, which is stated to have been imported from Saugor, was attributed to great scarcity of pure water. The disease is said to have been brought into the district of Seoni by beggars, one of whom died of cholera and was left unburied on the banks of a *nala* whence the water-supply of the village of Bareylee Kalan is taken. "The disease spread from this village rapidly." Regarding its introduction Dr. Hutcheson writes :—

"It was one of the worst epidemics the district has experienced. The suddenness with which the "disease spread, and its almost simultaneous appearance in circles widely separated, show that there "was some widespread local predisposing cause apart from importation. The disappearance of the "disease on the onset of the monsoon, and the extreme dryness and the high temperature of the "preceding months, seem to indicate that the predisposing cause was largely meteorological."

In the Raipur district the first case was that of a *malguzar*, who was attacked at Kutni station when returning from a pilgrimage to Allahabad. "The disease broke out "simultaneously in four outposts, and mostly among pilgrims." In this district, and in Bilaspur, the water-supply of the people is mostly taken from tanks which are filled by surface drainage. In a year of deficient rainfall these tanks are, of course, more than ordinarily polluted.

It would appear from the seasonal distribution of the deaths that the concentration of the polluted water-supply was a very favouring agent to the distribution of cholera in the province generally. In January there were only 29 deaths in three districts ; in February six districts had been attacked, and there were 829 deaths ; in March the deaths in fourteen districts aggregated 2,879 ; in April there was an enormous rise to 8,407, and only four districts were free from the disease ; in May the increase was maintained, and every district, except Burhanpur and Sambalpur, contributed fatal cases, of which 12,935 were registered. In June the maximum of 14,000 deaths was reached. In the beginning of July rain was general, and the number of deaths fell to 6,384. In August heavy rain fell, and the deaths declined to 4,931. In September the decline continued, and 1,816 deaths were registered, in October 424, in November 143, and in December 208.

The average death-rate in rural areas was 5·67 per 1,000, considerably higher than the urban average, which was 4·61. In some of the towns, however, the death-rates were enormously high—in eleven over 10 per 1,000. The highest death-rates were registered in Lakhnadon, a small town in the Seoni district, where 83 deaths yielded a death-rate of 41·05 per 1,000 ; in Mungeli 190 deaths, death-rate 39·95 ; in Damoh 382 deaths, death-rate 32·50 ; in Drug 124 deaths, death-rate 29·89 ; in Mandla 20·57 ; in Bilaspur 15·74 ; in Arung 15·42 ; in Khurai 12·91 ; in Sailu 11·36 ; in Umrer 10·94 ; and in Hatta 10·17. On the other hand, seventeen towns, including Burhanpur, escaped altogether, and in others the death-rates were comparatively low. Raipur, it is stated, was protected by its water-supply. In that town there were 71 deaths, equal to a death-rate of 2·99, as compared with the district rate of 9·10. The first few cases that did occur are said to have been due to importation, and the remainder to the contamination of a tank.

The number of deaths from cholera in Berar was 12,264, and the death-rate was 4·3 per 1,000, as compared with 4·2 in 1895, and 1·8 the average of the previous five years. The greatest mortality, as in 1895, occurred in Basim, where the death-rate was 7·3 per 1,000. The next highest rate was 6·9 recorded in Wun, and in the remaining districts the rates ranged between 4·2 in Amraoti, and 2·5, respectively, in Ellichpur and Akola. The average rate in rural areas was 4·2, against 5·3 in the towns. Among the latter five escaped, Karanja, Buroor, Sendurjana, Pusla, and Mehkar. The cholera history of these five towns during the last three years is remarkable. In 1894 eighteen of the thirty-seven towns in Berar were free from the disease ; among those that escaped were Karanja and Mehkar, while in Sendurjana and Pusla the two highest cholera death-rates in the province, 18·9 and 15·8 per 1,000, were recorded, Buroor coming fourth with 10·3. In 1895 only eleven towns escaped, including Karanja, Buroor, Sendurjana, and Pusla ; in Mehkar the death-rate was 5·3 per 1,000. Dr. Little drew special attention to the immunity of Sendurjana, Buroor, and Pusla in 1895, and it might be instructive to attempt the discovery of the reason of their continued immunity. As compared with the epidemic of the previous year cholera was more widespread, but, save in the district of Amraoti, less intense. As in 1895 the seasonal mortality was abnormal, but the abnormality was more pronounced. Usually the mortality from cholera in Berar is at a minimum in the earlier part of the year, rising towards the end of the hot weather to a maximum in August and September, after which the mortality suddenly falls, and then

steadily declines until the end of the year. In 1895 the disease was unusually prevalent in the earlier part of the year, and the provincial maximum was attained in July: though in Wun the maximum was reached in March, and in Amraoti and Ellichpur in May. In 1896 there was no great prevalence of cholera in January and February, but the number of deaths in March was far above the average, and the maximum was reached in April; there was a falling off in May, and a very remarkable fall in June. In July the number of deaths rose to the level of the mortality in May; in August there was a great drop, and after that a steady decline until the end of the year. It seems possible that the early rise was due to unusual contraction of the water-supply; and that the decline in June was due to the rainfall in that month. But an unusual seasonal distribution of mortality was not confined to cholera.

"This unusual seasonal incidence was not peculiar to cholera alone, but under other disease causes, "it will be seen that the months of March, April, and May were the months of highest mortality, "which points to some general and unusual influence throughout the province affecting the public "health.

"The general cause or causes which exercised this baneful effect on the health of the people is, "however, a problem impossible to definitely solve in the present state of our knowledge."

The recorded number of deaths from cholera in Madras in 1896 was 47,847, equal to a death-rate of 1·5 per 1,000, as compared with ·6 in 1895, and 1·6 the quinquennial average. No district escaped the disease, although in South Kanara, the Nilgiris, Kistna, Nellore, and Madras the mortality was comparatively slight. The highest district rate was 5·4 recorded in Coimbatore; this was followed by 4·7 in Bellary, and 3·5 in Anantapur. In Bellary, Malabar, South Arcot, and Tanjore deaths were recorded in every month of the year. The rural death-rate was much lower than the urban, 1·4 per 1,000, as compared with 2·3. Seventeen of the towns, including Cannanore, Nellore, Mangalore, Musulipatam, and Guntur, escaped altogether, and in others there were only a few deaths. On the other hand, some towns suffered very severely. In Kilakarai, a town in Madura, of rather more than 12,000 inhabitants, there were 751 deaths, equal to the enormous death-rate of 60·6 per 1,000. In Ambur in North Arcot 248 deaths yielded a death-rate of 23·4. In Vaniyambadi in Salem there were 289 deaths, and the death-rate was 18·2. In Tiruppattur in the same district 267 deaths gave a death-rate of 16·2. In Cochin (10·8), Tadpatri (10·0), Palamcottah (9·8), Berhampur (8·9), Karur (8·6), and Tinnevelly (6·5) exceptionally high rates were registered. By far the greatest mortality (17,999 deaths) occurred in December, followed by November (5,961) and September (5,898); the smallest number of deaths were recorded in March (274) and April (322).

There were 49 deaths from cholera in Coorg, and the death-rate was ·28 per 1,000, as compared with a quinquennial average of ·09. Six deaths in Virajendrapet and five in Fraserpet yielded an average millesimal death-rate in the towns of ·71, as compared with ·24 in rural areas. The deaths occurred in July (11), August (27), September (6), and December (5).

There were 35,404 deaths registered as due to cholera in the Bombay Presidency in 1896, and the death-rate, which in the previous year was only ·47 per 1,000, rose to 1·88, or ·58 per 1,000 in excess of the quinquennial mean. In the province of Sind there were only 5 deaths recorded in Thar and Parkar in June; but all the other districts were affected, although the epidemic was severe only in Bijapur (death-rate 6·59 per 1,000), Pooña (5·97), Ahmednagar (3·26), Belgaum (3·10), Satara (3·03), and Kolaba (2·08). The death-rate in rural areas, 1·90, was somewhat higher than the urban rate, which, although one-third of the towns escaped altogether, was 1·71. In many of the towns the cholera death-rates were very high; notably Athni (13·06), Wai (12·06), Godhra in Ahmedebad (11·30), Godhra in Panch Mahals (9·12), Broach (8·24), Junnar (7·39), Gadag Bettigeri (6·84), Pandharpur (6·57), Nasik (5·94), and Sengamner (5·65). The greatest prevalence of the disease was in the months of May to August inclusive, with the maximum in July.

The number of fatal cases of cholera registered in Lower Burma in 1896 was 2,959, equal to a death-rate of ·66 per 1,000 of the population, as compared with 1·14 in 1895, and 1·04 the mean of the previous quinquennium. Two districts, Kyaukpyu and Mergui, were entirely free from the disease, and, except in Myaungmya (2·02), Bassein (1·99), Thôngwa (1·29), and Tharrawaddy (1·26), the district death-rates were under 1 per 1,000. In rural areas the average death-rate was ·69, against an average in the towns of ·40. Fifteen towns escaped altogether, and, except in the small towns of Myaungmya (8·88), Maubin (4·69), Lemyethna (4·10), Letpadan (3·56), Zigon (2·89), and Gyobingauk (1·00),

the cholera death-rates were low. The greatest numbers of deaths were registered in the months of July, June, and May, and the least in March and February.

Among the populations of the four towns in Upper Burma in which deaths are registered, only two fatal cases of cholera were reported, both in Myingyan.

Summary of the cholera registers.—The following paragraphs are compiled from the official reports, by the officers in medical charge, of the occurrence of cholera among bodies of troops and among prisoners.

Cholera occurred among European troops on 25 occasions and in 21 different stations. There were in all 74 seizures, of which 64 proved fatal, a case-mortality of 86·49 per cent. On ten occasions only one man was attacked, and nine of these attacks were fatal. It is of interest to note that at the time of the occurrence of three of these isolated fatal cases at Amritsar, Campbellpore, and Mandalay no cholera was reported to be present in the neighbourhood. In two instances the first attacks were attributed to the consumption of fruit. At Muttra, where there were only two cases, the two men had gone out together and obtained some fruit; the kind of fruit is not stated, but they brought it back to barracks and ate it shortly before they were seized with cholera. A native servant who is said to have eaten some of the same fruit was attacked at the same time and died in the Civil Hospital. The first outbreak at Jhansi was attributed to the men having partaken largely of melons while on their journey to that station.

Cholera appeared in 56 bodies of men belonging to the Native Army, on 60 occasions and in 38 different stations. There were 212 seizures and 137 deaths, a case-mortality of 64·62 per cent. In 24 instances the attacks were single. Among the Europeans isolated attacks were not more fatal than others, but among the natives the case-mortality in such attacks was about 12 per cent. higher than in the remainder. In a few first cases the seizure was preceded by dietetic irregularities.

The occurrence of cholera among prisoners was limited in 1896 to the jails in Bengal, Assam, the Central Provinces, and Burma. Cases of the disease occurred in 36 jails on 47 occasions. There were 163 seizures, of which 98 proved fatal, or 60·12 per cent. The number of isolated cases was 21, and the case-mortality among them 71·43 per cent. In some instances the prisoners were attacked soon after admission to jail, and, on one occasion, the prisoner was actually suffering from cholera when brought to the jail.

At Darbhanga the first attacked was a man who had been drinking water from a tank, the water of which teemed with microbes, said to be "cholera" vibrios, but no connection between the first and subsequent cases was established, nor could the origin of the latter be discovered.

The history of the outbreak at Myingyan, where 6 cases and 3 deaths occurred, is of etiological importance. There was no cholera reported in the town of Myingyan, nor in the neighbourhood. The townspeople use river water, while the prisoners used water from wells. This well-water is highly charged with salts, but is otherwise of good quality, and was carefully boiled before use. Prior to the occurrence of cases of cholera, the general health of the prisoners had been indifferent, and diarrhœa was very prevalent. After the occurrence of the first case the well was "disinfected," but other cases of cholera occurred. "When cholera persisted in spite of disinfection of the wells," writes the medical officer, "I changed to river water on the 11th of July, after that there was "a single case on the 12th, and diarrhœa began to diminish."

Among European troops diarrhœa was specially prevalent at the time that cholera occurred at Indore (2 cases of cholera, both fatal) and Poona (14 cases, all fatal): among Native troops, at Dinapore (2 cases, 1 death); Sirur (18 cases, 9 deaths); and Agar (7 cases, 4 deaths): among prisoners in the jails, at Myingyan (6 cases, 3 deaths); and Darbhanga (30 cases, 24 deaths).

The following statement shews, approximately, the number of buildings occupied by the various bodies of men attacked, and the proportion which furnished cases of cholera :—

Communities.	Number of buildings occupied by bodies of men attacked.	Number of buildings which furnished cases.	Percentage of buildings which furnished cases.
European troops	380	40	10·53
Native „	11,163	142	1·27
Prisoners	527	76	14·42

Cases of cholera occurred under very many different weather conditions, but it is not possible to directly connect any of the latter with the former in the relation of cause and effect.

In many instances it appears that the question in the cholera register with regard to importation has been misunderstood. The use of the term "imported" should be restricted to those cases in which (1) cholera is brought from a locality in which it is known to exist to a locality from which it is known to have been previously absent, and (2) in which the connection of subsequent cases with the first is clearly traceable.*

In only one instance, the Malwa Bhil Corps, at Sirdarpore, is cholera said to have been imported into, and spread in, a regiment. At the time of the outbreak no occurrence of cholera in the villages surrounding Sirdarpore, within a radius of ten miles, was reported by the civil authorities, but there was cholera at a village some 15 miles from the cantonment. "Here a feast was attended by some women of the regiment. On their "return to cantonment two were attacked with choleraic diarrhœa, and the outbreak "followed in the regiment." These women were attacked on the 21st of June and recovered; but in his account of the epidemic, the medical officer describes it as having lasted in the station from the 14th June to the 12th August. Moreover, he notes that the first case seen was admitted into hospital from a village $2\frac{1}{4}$ miles west of the cantonment. The date of the occurrence of the first case in the regimental cholera register is the 26th June, and, admitting that the women attacked on the 21st June suffered from cholera, it would appear that the disease was present in the immediate neighbourhood of the cantonment before their attack. Cholera may have been imported to the neighbourhood, but it cannot be correctly said to have been imported into the regiment.

Attendants attacked by the disease.—The following statement shews the number of persons who attended on cases of cholera, and the percentage that were attacked:—

Communities.	Number of cases of cholera treated.	Attendants.		Percentage of attendants attacked.
		Number.	Number of those attacked.	
European troops	74	287	1	·35
Native „	212	605	7	1·16
Prisoners	163	266	8	3·01

The medical officers who describe the outbreaks among soldiers do not, in any case, ascribe the attack of attendants to the fact of their attendance. It may be noted that at Sirdarpore (33 cases) the attendants suffered in proportion to their numbers twice as much as the rest of the regiment, but there were other causes than attendance that might account for this. Four of the persons in attendance during the outbreak in the Bankipur Jail (38 cases) were attacked, but the incidence of the disease among attendants was less than among the main body. At Darbhanga (30 cases) four prisoners were attacked while attending their fellows, and the medical officer was of opinion that, as the attendants were seized while actually engaged in looking after the sick in the cholera tents, the attacks were due to such attendance. Now, the percentage of prisoners attacked was about 14, while no less than 20 per cent. of the 20 prisoner attendants suffered; but five sweepers were also employed with the sick, none of whom were attacked, and their inclusion in the calculation lowers the percentage of attendants attacked to 16; while, if the nine members of the jail staff in actual personal attendance on the sick are also included, the percentage of attendants attacked falls below 12.

In this connection, the remarks of the medical officer of the 1st Battalion of the 2nd Gurkhas, regarding the protection afforded to that regiment by a good water-supply, may be quoted:—

"In the present year we have again had cholera freely imported into both battalions, but it quite "failed to take root. I consider the history of the cholera outbreaks in this regiment, and the way "they have been affected by its water-supply, as of the most supreme interest, and very complete and "valuable as one of the many proofs of the water-borne theory of the spread of the disease and the "great security and protection a really protected water-supply gives.

"Before 1892 the history of the 1st Battalion shows that it invariably suffered terribly when "cholera appeared in the Doon, so much so that some years ago the site of its lines and cantonments "had to be moved over two miles away from the city—of course at very great expense."

* *Vide* Sanitary Commissioner's Report for 1894, page 151.

The more important sanitary defects reported in connection with the occurrence of cholera in jails include—bad drinking-water at Myingyan; insufficient drinking-water at Damoh; a double water-supply at Bankura, where the prisoners preferred the water of a filthy tank in the vicinity of the jail to boiled river water; the proximity of a contaminated tank at Darbhanga; slight overcrowding at Balaghat; overcrowding in the sub-jails at Patuakhali and Khurda; great overcrowding at Damoh.

Effects of movement.—The effect of movement, when practised, was invariably favourable, not only in respect of the cessation of cholera, but on the general health. In more than one instance the weather was most unfavourable, but the health of the men improved, shewing that, granted reasonable care in the selection of a suitable camping-ground and precaution against unnecessary exposure, troops can be moved without danger and with advantage in all ordinary circumstances. Among the prisoners at Bankipur and at Darbhanga, 18 and 16 seizures respectively occurred after the moves; but in both occasions the epidemic ceased within four days after movement.

Other details regarding the occurrence of cholera.—The two cases among Europeans in Fort William are good examples of sporadic attacks in a community. On the early morning of the 29th of March, two warders in the Military Prison were admitted to hospital with the signs and symptoms of cholera. Both cases were typical, and both proved fatal on the evening of that day. There was absolutely no connection between the two warders, one of whom, an elderly man, had his meals with his wife, while the other messed with his brother warders.

The single case at Rurki is an example of "administrative" cholera. A sergeant had been for some time at Hardwar where there was cholera. On arrival at Rurki he was suffering from diarrhœa, accompanied with considerable vomiting, which persisted for four days, when he was admitted to hospital suffering from vomiting and purging, and the possibility of cholera was suspected. There was partial collapse, and moderate cramps, but no suppression of urine or secondary fever, and recovery ensued. Clinically the diagnosis was doubtful, but as the Government bacteriologist at Agra reported the discovery of the "cholera" microbe in a portion of the dejecta, the case was returned as cholera.

Small-pox.

The deaths from small-pox in 1896 in the parts of India under registration numbered 141,443, or 95,710 more than in the preceding year, the ratio per 1,000 of population being 0·65 against 0·21. The increase in ratio was general, affecting all provinces, but was greatest in the case of Ajmere-Merwara and the Punjab, which had also the highest ratios.

The mortality rose month by month from the beginning of the year up to its maximum in May, then sank month by month to its minimum in October, and finally rose again to the end of the year; and in the individual provinces the general course of the mortality curve was similar. Of the total deaths of the year, 64 per cent. occurred in the five months, March—July, and nearly 8 per cent. in December.

The following shews the mortality from small-pox in the different provincial registration areas of India in 1896, month by month:—

Statement shewing the deaths from Small-pox registered in the different Provinces by Months during the year 1896.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.		RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1896	1895	1896	1895
Bengal	1,037	1,060	1,659	1,740	1,846	2,322	888	598	302	314	563	1,059	13,388	13,020	0·19	0·18
Assam	433	385	547	582	808	752	399	272	266	236	301	463	5,444	3,849	1·08	0·77
North-Western Provinces and Oudh.	710	1,284	2,869	5,176	7,854	8,008	5,778	2,794	1,206	785	2,011	4,296	42,771	1,968	0·91	0·4
Punjab	3,274	3,563	4,918	5,967	8,047	6,581	4,192	2,081	1,040	1,048	1,753	2,620	45,084	8,334	2·19	0·41
Central Provinces	619	717	1,022	1,261	1,359	874	614	402	147	146	243	343	7,747	6,644	0·82	0·70
Berar	84	79	147	169	92	66	44	36	12	15	13	53	810	556	0·28	0·20
Lower Burma	79	143	275	227	255	187	151	129	100	45	39	39	1,669	1,540	0·37	0·34
Madras Presidency	675	847	1,182	910	794	682	682	598	533	536	780	1,191	9,410	5,111	0·29	0·15
Bombay „	465	701	1,385	1,392	939	578	296	130	84	76	158	239	6,443	2,299	0·34	0·12
Ajmere-Merwara	628	834	1,174	730	284	74	43	18	6	6	14	10	3,821	754	7·05	1·39
Coorg	—	—	3	4	3	2	4	2	—	—	—	—	18	7	0·10	0·04
Mysore	152	250	414	429	392	483	634	502	323	392	434	433	4,838	1,651	1·00	0·34
TOTAL	8,156	9,863	15,595	18,587	22,673	20,609	13,725	7,562	4,019	3,599	6,309	10,746	141,443	45,733	0·65	0·21

The number of deaths recorded as due to small-pox in Bengal in 1896 was 13,388, or 0·19 per 1,000, as compared with the 0·18 of the previous year, and with the average of the past ten years, which was 0·15. The only district in which the disease can be said to have prevailed in an epidemic form was Patna, in which the death-rate was considerably in excess, not only of that of the previous year, but of that of the decennium. That district is very backward in vaccination, and it is to that cause, says the Sanitary Commissioner, that the high rate of mortality is to be attributed. The Civil Surgeon of Patna has no hesitation in saying that the disease was originated and spread by the practice of inoculation. Indeed, he has been assured that the Government vaccinators (of the *mali* caste) are quite willing to oblige by performing either vaccination or inoculation according to the wishes of the children's guardians. Death-rates over 0·50 per 1,000 were recorded in the districts of Patna (1·20), Cuttack (0·70), Shahabad (0·69), and Puri (0·66); in eighteen districts the rates varied from 0·39 to 0·10; and in twenty-three from 0·09 to 0·001; while in the Khulna district only there was no death. The urban death-rate was 0·31, as compared with a rural rate of 0·18. Mortality ratios of over 2 per 1,000 distinguished the towns of Raniganj in the Burdwan district, Patna in the Patna district, Deoghur in the Sonthal Perganas, Roserah in the Darbhanga district, Bhadreswar in the Hooghly district; and the rural areas of Maner in the Patna district, Aul in the Cuttack district, Khajri in the Midnapore district, Phulwari and Patna in the Patna district, and Gop in the Puri district. The number of deaths among children under one year of age rose from 1,924 in 1895 to 2,805 in 1896; and among children from one to twelve years of age from 4,707 to 7,026; and the percentage of children's death in the total small-pox mortality of all classes from 50·92 in 1895 to 73·43 in 1896.

Among the European seamen in the port of Calcutta 1 non-fatal case occurred against 9 cases with 1 death in the preceding year. Among the native floating population there was 1 death from small-pox against 5 in 1895, the respective ratios being 0·03 and 0·19 per 1,000.

In Assam there were 5,444 deaths from small-pox registered during 1896, against 3,849 in 1895, and against 2,370, the average of the five years 1890–94. The death-rate was 1·08, as compared with 0·77 in the previous year. The highest district death-rate, 4·16 per 1,000, representing 1,058 deaths, was recorded in Lakhimpur. The disease had been prevalent to a less extent in the preceding year, spreading from the town of Dibrugarh, into which it had been introduced by three passengers who came in a trading steamer from Calcutta. The next highest death-rate was registered in the Kamrup district, where 1,845 deaths yielded a ratio of 2·91 per 1,000. The outbreak began in the preceding year at the town of Barpeta, into which it was brought by a student from Calcutta. The inhabitants of Barpeta refused to allow themselves or their children to be vaccinated; and the consequence was that the outbreak was not speedily stamped out, and 60 deaths occurred in 1896. The Civil Surgeon of Kamrup states that the increased small-pox mortality was chiefly due to deaths from chicken-pox and measles having been returned as deaths from small-pox; but, as the Sanitary Commissioner points out, though deaths from measles are doubtless frequently returned under small-pox, the mortality from genuine chicken-pox cannot have been large. In the Sibsager district 1,024 deaths from small-pox were recorded, as against 37 in 1895. In nine towns there were no deaths from small-pox, and in the others the mortality ratio ranged from 5·05 at Barpeta, and 4·82 at North Lakhimpur, to 0·27 at Silchar. Among infants under one year of age there were 1,119 deaths, more than 20 per cent. of the total, and among children between one and twelve 2,914 deaths, more than 53 per cent. of the total.

In the North-Western Provinces and Oudh the lowest recorded death-rate from small-pox in the twenty-six years, 1871—1896, was 0·04 from 1,968 deaths in 1895. But in 1896 there were 42,771 deaths from small-pox, giving a ratio of 0·91 per 1,000. This is a considerable rise, and was anticipated by the Sanitary Commissioner; so large a proportion of the population being still unprotected. There are periods of exacerbation of the disease after intervals during which susceptible material has been accumulating. Considerable difficulty is experienced in persuading adults to revaccination, principally because it temporarily cripples them, and prevents them from following their usual occupations. The districts with mortality ratios higher than 2 per 1,000 were Allahabad (4·10), Unao (3·85), Bareilly (2·39); and there were 15 districts with ratios over 1 per 1,000, 9 with ratios not below 0·5, 18 with ratios over 0·05, only three with ratios under 0·05, and no district without a small-pox death. The highest ratios in towns were in Nehtor (12·86), and Kiratpur (10·05), in the Bijnor district, and in Aonla (10·10), in the Bareilly district. But the epidemic was very widespread, and 77 out of 100 principal

towns returned cases of this disease. The urban mortality was 0·86 as compared with 0·92 in the rural areas. Among infants under one year 14,410 deaths occurred, against 580 in the previous year; and among children under twelve years of age but not under one year, 26,443, against 1,329. Again, the percentage of deaths of the former class of children to the total small-pox mortality of all classes of the population was nearly 34 against 29 in 1895, and that of the latter class of children to the same, nearly 62 against 67.

A most severe epidemic of small-pox visited the Punjab during the year, the total number of deaths registered being 45,084, and the death-rate 2·19 per 1,000 of population; and it was the severest epidemic since 1879. The disease broke out in a virulent form in December 1895, and, in accordance with the experience of former years, attained its maximum intensity in May, after which there was a steady decline in mortality down to the minimum in September-October, the numbers again rising as the cold weather set in. The highest district death-rate was in Ferozepore (5·75), and the lowest in Kangra (0·05). Besides these, four districts had ratios over 4 per 1,000, five over 3, four over 2, seven over 1, four over 0·5, and five over 0·05. The districts with higher mortality were not, with the exception of Gujrat, among the best vaccinated districts of the Punjab; but the five districts with the lowest mortalities were so. The remarkable immunity of Kangra is attributed by the Sanitary Commissioner to the fact that it stands first in order of the best vaccinated districts in the province. The rural death-rate was 2·18, and the urban 2·36. In the case of towns the highest ratios were those of Kasur (9·61), and Bhera (9·30), and the lowest that of Dera Ghazi Khan (0·08). Two towns had ratios over 9 per 1,000, three over 8, two over 7, two over 6, two over 4, five over 3, eight over 2, seven over 1, eight over 0·5, and six over 0·05. Out of the 45,084 persons who died from small-pox, 13,065, or nearly 29 per cent. were children under one year of age; and 26,192, or over 58 per cent. children between the ages of one and twelve. It is evident, therefore, that many children must have been unprotected by vaccination; and the Sanitary Commissioner has taken steps to increase vaccination in the districts in which small-pox mortality was highest.

The number of deaths from small-pox in the Central Provinces was 7,747 against 6,644 in 1895; and the ratio per 1,000 of population was 0·82 against 0·70 in 1895, and against 0·25, the quinquennial mean. The disease prevailed with greatest intensity in the hottest month (May), and declined with the approach of the rains. The increase of mortality affected every district without exception, the greatest number occurring in Wardha, Chanda, Bhandara and Raipur. The highest ratio to population was that of Wardha (2·63), and the lowest that of Burhanpur (0·04). One district had ratio of over 2 per 1,000, four of over 1, eight of not less than 0·5, six of over 0·05, and one of under 0·05. The rural mortality was 0·85, and the urban 0·40. The towns with the highest ratios were Lakhnadon (8·41), Arvi (7·54), and Warora (4·29). Mohgaon was the only other town that had a ratio over 3 per 1,000 and there were 29 towns which recorded no deaths. In the 7,747 persons that died from small-pox were included 1,943 children under one year of age, or over 25 per cent., and 3,536 children between the ages of one and twelve, or nearly 46 per cent.

In Berar the total number of deaths registered from small-pox was 810, against 556 in the previous year; while the death-rate per 1,000 was 0·28, against 0·20 in 1895, and against 0·1, the quinquennial mean. As usual, the disease prevailed with greatest intensity in the three months March-May, declined thereafter, but rose again in the cold months at the end of the year. Among districts Amraoti had the highest death-rate (0.6), and Buldana the lowest (0·008). The Amraoti district ratio was yielded by 415 deaths, or more than half the total number recorded in the administration. In this connexion the Sanitary Commissioner noticed that in Amraoti influenza deaths, under the native name *kapsi matha*, were at first registered under small-pox, and that, though the mistake was remedied as much as possible, yet it probably served in some degree to raise the mortality under the head of small-pox in that district. The rural mortality was 0·2, the urban 0·7; but the disease, though more localised in towns than rural circles, was pretty general throughout the districts most affected. The towns with the highest ratios were Pathur (5·8) and Bulgaon (4·7), and the greatest number of cases occurred in the towns of Pathur and Akote. Out of the 810 persons who died from small-pox 162, or 20 per cent., were under one year of age, and 398, or over 49 per cent., between one and twelve.

The number of deaths from small-pox in Madras Presidency in 1896 was 9,410 against 5,111 in the previous year; and the death-rate was .0·29 per 1,000 of the population against 0·15 in 1895, and against 0·8, the quinquennial mean. The highest district ratio

was that of Kurnool (1·8), and the lowest that of Coimbatore (0·02). There were in all three districts with ratios over 1 per 1,000, one over 0·5, thirteen over 0·05, and five 0·05 or less. The urban ratio was the same as the rural ratio, namely, 0·3 per 1,000. The towns with the highest ratios were, in order, Vellore (5·3), Arcot, Nandyal, and Gudiyattam. Children under one year of age furnished 2,245 deaths, or nearly 24 per cent. of all the persons who died from small-pox; and children between the ages of one and twelve 3,632 deaths, or nearly 39 per cent.

In Coorg the total number of deaths from small-pox registered was 18 against 7 in the preceding year; and the ratio of deaths per 1,000 of population was 0·10 against 0·04 in 1895; and against 1·90, the mean of the quinquennium. Deaths were recorded in only 11 out of 517 villages in the province. The rural death-rate was 0·11, but there was no urban mortality. No children under one year of age died of small-pox, but five, that is nearly 28 per cent. of all the persons that died of it, succumbed between the ages of one and twelve.

In the Bombay administration there were in the year 1896 small-pox deaths to the number of 6,443 against 2,229 in the preceding year; and the ratio was 0·34 against the 0·12 of 1895, and the 0·18 of the decennium. As in 1895, and as in the five years preceding that, the disease reached its maximum intensity in April, then declined, but rose again in the end of the year. The highest ratios were in the Western and in the Gujrat Registration Districts, and the extreme district ratios were 0·94 for Khandesh and 0·01 for Sholapur and Bijapur. Five districts had ratios over 0·5 per 1,000, sixteen not under 0·05, and four under 0·05. The urban mortality ratio was 0·70, while that of the rural areas was 0·30. The highest town ratios were those of Godhra (10·55), Dhulia (3·02), and Umarkot (2·97). The total 6,443 deaths from small-pox include 1,901 of children under one year of age, or over 29 per cent., and 3,336 of children between the ages of one and twelve, or nearly 52 per cent.

There were 1,669 deaths from small-pox during the year in Lower Burma, and the death-rate was 0·37 per 1,000, as compared with 0·34 in 1895, and with 0·40, the mean of the previous five years. The disease persisted throughout the year, but was most fatal in March, May, April, and June, and least so in November, December, October, and January. The three districts of the Arakan Division, the Prome district, and the Mergui district had no small-pox mortality. The highest ratio, 1·17, was that of the Hanthawaddy district, and the lowest ratios, 0·01, that of Tavoy and that of Thayetmyo. Three of the districts had ratios of 1 per 1,000, none over 0·5, 7 over 0·05. The rural death-rate was 0·36, and the urban 0.47. The highest town ratios were 3·82 at Kyangin, and 1·13 at Rangoon. Out of the 1,669 persons who died from small-pox 247, or nearly 15 per cent., were under one year of age; 814, or nearly 49 per cent., between the ages of one and twelve. Unprotected coolie immigrants from India are reported by the Sanitary Commisioner to be a prolific field for the propagation of small-pox, and proposals for remedying the evil are now under consideration.

Plague.

In the latter part of 1896 bubonic plague appeared in Bombay. By the end of the year, 2,911 cases were reported throughout the Presidency, of which 2,219* were fatal, equal to an annual death-rate of ·12 per thousand of the population. A full account of the outbreak will be found elsewhere,† and the following paragraphs contain only an outline of the principal events which occurred in 1896.

In the Bombay Presidency, scarcity and high prices consequent on abnormal meteorological conditions determined a migration specially of the very poor people to the City of Bombay in search of work. The sanitary condition of the city itself was bad. For years past the drains have been insufficient to carry off the water brought into the city, and, in 1896, the state of drainage was rendered much worse than usual by abnormal meteorological conditions. The total rainfall, although less than the average, was abnormally distributed, and instead of falling during about four months lasted for six weeks only. In June, July, and August there was an aggregate excess of 27 inches beyond the average, and, to make matters worse, an obstruction formed at the sewage outfall during a great storm, when it was impossible, on account of the heavy sea that was running, to send men to remove it. In consequence the low-lying portions of the city

* The figures for Bombay City are taken from the Report of the Municipal Health Officer. Figures for the Presidency, outside Bombay City, are taken from the Report of the Sanitary Commissioner for the Government of Bombay.

† *The Plague in India, 1896–97.* Government of India, Home Department.

were flooded with storm-water and sewage, and in places not reached by direct sunlight the walls of houses and lanes remained damp for long afterwards, in spite of the excessive heat of the autumn. In September, instead of a rainfall of eleven or twelve inches, there was only about an inch and an half, an amount which was, of course, inadequate to wash away the stagnating impurities. October was dry and hot.

In Bombay the poor live in the most insanitary conditions, crowded together in high buildings called *chawls*. These *chawls* or tenements may run up to seven storeys, and the unit of construction is a long corridor with rooms opening on each side. In the corridor, either at one end or in the centre, is situated a water-tap with bathing-platform, and alongside it a latrine with two or three seats. The whole tenement is built up of congeries of these corridors and rooms, and contains from 500 to 1,000 individuals. The only space between each tenement is a gully sufficiently wide to admit a sweeper. In most of the corridors and rooms, either from the absence of openings or the obstruction of the existing ones, there is absolutely no light admitted and consequently no ventilation. It is stated that 70 per cent. of the population live in such houses.

The conditions in Bombay in August, then, were overcrowding of multitudes of very poor people in unventilated, damp, and filthy houses; the subsoil sodden with sewage, and the drains in many in places choked; add to this the putrefying of great quantities of food-grains in the hot moist air of flooded cellars.

The abnormal climatic features of the year had made the city very unhealthy, and in June, July, and August, the period immediately preceding the discovery of the existence of the plague, the death-rate had been high,—much higher than the quinquennial average for these months.

The high mortality during this period has been held to indicate that plague, although undiscovered, was present in the city, and there are those who believe that the disease was present in May. There certainly are two phenomena which give colour to this belief; one the existence of cases of a mysterious and fatal fever which were seen by native practitioners from May onwards; the other, the very wide distribution which the plague was found to have when its existence in the city was recognised. But the main argument, the comparatively high mortality during the monsoon months, falls to the ground in view of the fact that, although the death-rate in June, July, and August, 1896, was higher than the average death-rate during the same period in the preceding quinquennium, it was very considerably lower than in these months in 1894. In both years cholera was prevalent, in the earlier year slightly more so than in 1896, although the excess is not sufficient to account for the higher death-rate in 1894. Regarding the incidence of the mortality, the Health Officer points out that the high rate in August was due to the increase in the number of deaths among persons who were not natives of Bombay City. It is remarkable that, although the total mortality rose, the increase until the end of November was due to deaths among persons born outside of Bombay, while the number of deaths among those born in the city actually fell. Even in December, when there was an enormous rise in the total mortality, it was mainly due to deaths among outsiders.

When plague was detected, the distribution of cases indicated that it must have been present in the city for a considerable time. The failure to diagnose early cases is not extraordinary in view of the prevalence of a pneumonic type of the disease, and of the existence in Bombay, during recent years, of cases of fever with glandular enlargement.

As the date of the occurrence of the first case cannot be determined, the place of origin remains unknown. Its introduction has been ascribed to pilgrims from Garhwal who are said to have brought it from the Himalayan endemic area. In the absence of any positive evidence, it may, perhaps, be assumed that the place of origin was China; and there is possibly greater likelihood of the disease being brought from a place where it was raging epidemically than from any endemic area.

On the 10th of August, the Municipal Health Officer heard of the occurrence of two cases of fever accompanied by enlarged glands in the neck. On the 21st and 24th August, Dr. Ismail Jan Muhammad saw two cases in which the patients suffered from small glandular enlargements in the groin, lung complications, high fever and delirium. A case of bubonic fever was registered on the 31st of August. The first public announcement of the epidemic presence of the disease is due to Dr. Viegas, a private practitioner, who saw a case on the 18th of September, and diagnosed it to be plague. The existence of the disease in the city was officially intimated to the Municipal Commissioner on the 23rd September.

Whatever may be the actual date of the commencement of the epidemic, it was very widely spread in September, and before the end of that month cases occurred in no less than 21 of the 32 districts into which the city is divided. In September the effect of

plague deaths on the death-rate was very marked, and the mortality rose not only far above the mean for September of the previous quinquennium, but far above the September mortality of any of the years composing it. The excess mortality was not, however, shown as plague, for only 79 deaths from that disease were recorded, but as "fever," and among the diseases returned under the heading "all other causes," which included a very much larger number of deaths from affections of the respiratory organs than usual.

The epidemic began in Mandvi, a densely populated quarter situated immediately to the north of the Esplanade ward, and on the east of the centre of the city. It was in this ward, where conditions were very favourable for its development, that the epidemic was most severe in 1896. From Mandvi the disease spread, and in September, as we have seen, cases were discovered in 20 other wards of the city. In October five more wards were attacked, Second Nagapada, First Nagapada, Kharatalao, Mahalaxmi and Esplanade. In November the epidemic had spread to Walkeshwar, South Fort, Upper Colaba and Chowpatti; and in the beginning of December the remaining two wards, Mahim and Sewree, were attacked.

In September 135 cases and 79 deaths were reported. In October the number of cases had risen to 406, and the deaths to 313. In November the number of cases and deaths, 339 and 273, were considerably lower, a lull which raised hopes that the epidemic might speedily die out; but in December, an enormous rise in the number of cases to 1,664, with a corresponding increase in the number of deaths to 1,271, showed that these hopes were vain. The directions taken by the epidemic were generally west and north, the invasion of many districts being heralded by the immigration of rats. Dr. Weir is of opinion that the disease was carried from ward to ward by the rats, stating in support of his belief that the disease spread in the directions in which rats migrated, rather than the direction taken by the dispersing people. However this may be, the distribution of the disease appeared to follow groups of houses and was hardly ever found evenly distributed over a district. The death-rates were highest in Mandvi (308 deaths, or 8·25 per 1,000 of the population), Kamathipura (227 deaths, or 7·77 per 1,000), Middle and Lower Colaba (77 deaths or 5·65), and lowest in Upper Colaba and Esplanade, in each of which only one death was reported, and in South Fort where there were only two. It is remarkable that several of the most populous wards in the city showed comparatively very low death-rates from plague, but this may be accounted for by the dispersion of the people in the city itself, and by the flight from the city of enormous numbers. The estimated number that left Bombay in October was 20,000, and in November and December 171,500.

On the 29th September the Government of Bombay deputed their chief medical authority, the late Surgeon-Major-General Cooke, to enquire into the nature of the disease. He reported that he had seen about 20 cases of bubonic fever. Plague was officially declared to be present in the city, and the Government of India were informed. Instructions were immediately issued by the Government of India to M. Haffkine to proceed to Bombay and make a thorough bacteriological enquiry into the nature of the disease. M. Haffkine's examination confirmed the results already obtained by Dr. Surveyor and Surgeon-Captain Childe, and his report reached the Government on the 13th October. Meanwhile preventive measures were being energetically undertaken by the municipal authorities. At the time of Surgeon-General Cooke's inspection he found that sea-water was pumped through the sewers all night by means of a powerful pump, and cleansing, disinfection, and limewashing of walls were in active progress, fire-engines being employed in the work. Surgeon-General Cooke suggested that the sanitary and medical staff of the Municipality should be increased; that the sick should be segregated in hospital; that the bedding used by the sick, or found in the houses or rooms occupied by them, should be thoroughly disinfected or burned; that more complete arrangements for the carting away of filth from the sewers should be made; and that measures should be taken to secure the early detection of cases should they occur in suburban municipalities.

Before the end of September the Local Government had appointed a Committee, consisting chiefly of medical officers of the Government and private medical practitioners, of which the Municipal Commissioner was Chairman, to concert remedial and preventive measures. At the first meeting at the end of the month, Surgeon-General Cooke's proposals were considered. The late Surgeon-Major Manser insisted on the necessity for the complete disinfection of every house in which cases were known to have occurred and suggested the removal of the inhabitants of such houses to empty buildings or tents on the Port Trust Estate. The Chairman pointed out that this could not be done unless special powers were obtained from Government, and a resolution was adopted by the meeting that application for such powers should be made. On the 2nd of October wide powers were conferred by Government on the Municipal Commissioner to enable him to

take whatever action was found to be necessary to check the epidemic. The Corporation voted sums of money to defray the cost of sanitary measures, and a large additional medical staff were employed to carry out the extensive operations advised.

On the 6th of October the Municipal Commissioner issued a proclamation, under section 434 of the Municipal Act, making special provision for the removal to hospital of those infected, and for the evacuation and cleansing of infected houses. This proclamation excited the wildest terror among the people ; many fled, small riots occurred, and a great danger threatened, for the conservancy establishment became affected by the general unrest and a strike among them, which must have been attended by appalling results, was feared.

In view of these circumstances, the original orders were modified, and it was provided that the sick should not be moved if they were resident in houses in which they could be isolated in a reasonable degree, and could receive proper attention. Assurance was at the same time given that every allowance would be made by the officials of the Health Department, when compelled to enter houses, for the customs enjoined by caste rules. On the 30th of October these conditions were further modified by the statement that the foregoing notifications had been issued in view of a great increase in the number of cases of plague ; and it was further promised that no person would be removed to hospital who could be properly treated and segregated at home, and that, in any case, no action would be taken except upon the certificate of a duly qualified practitioner.

These orders virtually abolished compulsory legal segregation of the sick ; but efforts to secure isolation were continued, and it was sought to attain by persuasion what it appeared impossible, in Bombay at least, to attain by legal compulsion. Private hospitals were opened, but the people seemed to dread removal to them almost as much as to the Government hospitals ; while those residing in the neighbourhood where hospitals were established raised an outcry that their houses were being infected. It was not until December that private hospitals became at all successful.

In the meantime, the Government of Bombay by a resolution, dated the 13th October, appointed a scientific committee to enquire into the nature of the plague. Surgeon-Major Manser was appointed President, and undertook an enquiry into the treatment of plague by drugs. Surgeon-Captain Childe undertook the study of the general pathology of the disease ; Mr. Hankin, the study of the behaviour of the microbe of plague in nature ; M. Haffkine, the general bacteriology, and specially, the questions of immunity and of protective and therapeutic inoculations ; Dr. Surveyor the study of the disease in rats.

In November and December the work of cleansing and disinfecting was carried on with greatest energy ; but, aided though these measures were by the great exodus of the population, without making any preceptible headway against the epidemic, although it may be believed that, but for these efforts, the mortality would have been enormously greater than it was.

Bombay Presidency.—The exodus of the people was no doubt of great advantage to Bombay, but it was a terrible danger to the rest of the country ; many persons fled while actually suffering, and many fell sick on the way to, or after they arrived at, their destinations. The municipalities in the districts had, of course, been warned, and those on the line of rail did what they could to keep out infection by instituting medical inspection of passengers from Bombay. Inspections were attended by considerable success, but could not be effective in the absence of legal powers, and before the end of the year there had been 367 cases reported, or discovered, in 47 places in the Presidency, with 283 deaths.

There can be no doubt that the numbers of cases and deaths are much understated. Many cases were concealed, and deaths were returned as due to causes other than plague. As the figures stand, however, it may be noticed that the reported case-mortality in places outside Bombay was nearly 10 per cent. higher than in the city itself. Notwithstanding the large number of places into which the disease was introduced, in only five, one of them Bandra, practically a suburb of Bombay, had the pestilence taken root before the end of the year.

Ahmedabad was the first place outside of Bombay in which a case was reported. The first case (A), a very slight one terminating in recovery, occurred in the person of a Musalman who had been working in Mandvi, in Bombay. On the 18th September he suffered from slight glandular enlargement and fever, and on the 25th left Bombay for Ahmedabad, and was under the treatment of a local practitioner there for eight days.

On the 4th October he was seen by the Health Officer, who considered the disease from which he was suffering to be plague. The next two cases (B and C) were indigenous, and no connection whatever could be traced between them and the first case. The origin

of the infection could not be traced. One of the men had not recently been out of Ahmedabad. He was taken ill on the 28th September and died on the 3rd of October. The other had returned from Wadhwan, in Kathiawar, on the 17th September, and was taken ill after the 26th September—the exact date is not stated—and died on the 5th October. The houses of A and C were disinfected, and the hut in which B had lived was burnt. The city was cleansed. A staff was engaged to examine passengers from Bombay; arrangements made to disinfect luggage and goods at the railway station; and an isolation hospital prepared. No other indigenous case was reported before the end of the year. Nine imported cases were detected at the railway station in October; none in November; but 38 in December. Of the 50 cases which were discovered, 26 were fatal.

At Poona, from the 30th of September onwards, two medical men and four assistants were posted at the railway station to examine passengers. Four cases were detected at the station in October, one in November, and 43 in December, besides four cases in the city and one in the cantonment. The sick were isolated, but, in the absence of a law authorising compulsory measures, great difficulty was experienced in persuading the relatives and friends of the sick to allow them to be taken to isolation hospitals.

The first case at Bandra was reported on the 16th October. Isolation and other measures were recommended, but the municipal authorities were slow to move, the people opposed all measures, and plague progressed.

Sind.—The first case was reported in Karachi on the 10th of December. Karachi had defended itself against Bombay by quarantine rules, and it is remarkable that the origin of the first two cases could not be traced to Bombay or to any place outside Karachi, although most minute and careful enquiries were made.

Here the municipal authorities acted with great promptitude and gave effect to all the measures of prevention which were recommended for their adoption. Unfortunately compulsory segregation was not possible. In spite of much concealment, by the end of the year reports of no less than 63 cases and 59 deaths were received.

India, generally.—To prevent the extension of the disease to other provinces, the Government of India modified existing railway rules regarding infectious diseases so as to include plague, and instituted railway inspections at the large railway stations and important junctions; while measures of quarantine were adopted at the ports of Aden, Calcutta, Madras and Rangoon.

In all the larger towns special sanitary inspections were made, and so far as possible the towns were cleansed and put in a more favourable position to keep out plague; while isolation hospitals were got ready for the prompt segregation of persons who might be attacked. No indigenous case of plague was reported in India outside the Presidency of Bombay in 1896; but there were four imported cases in Rajputana and one in the Central Provinces.

Calcutta.—The most pressing danger seemed to be the infection of Calcutta, on account of the constant communication with Bombay, and the extremely filthy and overcrowded condition of great portions of the town. Under the orders of the local Government, a strong Medical Board was organised to deal with all matters appertaining to the prevention of plague, and special health officers were appointed to carry out sanitary surveys of Calcutta, Howrah and adjacent municipalities.

Great alarm was occasioned in October by the alleged discovery of cases of plague in Howrah and Calcutta. The cases of sickness had some clinical resemblance to slight attacks of genuine plague; but the medical men who made the diagnosis relied mainly on the discovery, in blood and serum taken from the sick, of a diplobacterium, which they believed to be the specific microbe of plague.

A closer examination of the antecedents of, and clinical symptoms exhibited by, the sick, which was undertaken by the Inspector-General of Civil Hospitals, did not support the diagnosis,—even of *pestis ambulans*: and the bacteriological enquiry, conducted at the instance of the Medical Board, by one of their members, Dr. D. D. Cunningham, F.R.S., Special Assistant to the Sanitary Commissioner with the Government of India, effectually disposed of the alleged discovery. Dr. Cunningham shewed (*a*) that the blood in which the diplobacteria were discovered had been exposed to external contamination; (*b*) that the bacteria isolated differed from each other and from the genuine microbes of plague; (*c*) that no microbes at all could be cultivated from specimens of blood taken from the suspected cases when proper precautions to avoid contamination were observed; and, finally, (*d*) that the death of an animal into which a culture was injected proved nothing, as the quantity of decomposing fluid injected was sufficient to cause death from blood-poisoning.

Dr. Cunningham, in addition, demonstrated the fact that the alleged "plague bacillus" might be discovered in specimens of the blood taken from healthy animals, if the blood was exposed to the air for a short time.

Fevers.

The total number of deaths registered under the heading "fevers" rose from 4,266,293 in 1895 to 4,578,944 in 1896, and the ratio per 1,000 of population from 19·53 to 21·05. The months of greatest mortality were March, January, and December, and those of least mortality, July, June, and May. Each of the first nine months of 1896 had more deaths, and each of the last three fewer than the corresponding month of 1895. The increase over the previous year was specially marked in March. It seems possible that the reduction in the last three months may have been due to the comparative absence of malaria in a dry year; and that the increase in the earlier months may have been due to the inclusion in the statistics of diseases then prevalent, such as influenza, chest complaints, small-pox, cholera, etc.

The greatest increase was in the Central Provinces, where also certain districts had higher mortality ratios than in any other province, ratios between 50 and 60 per 1,000. The lowest district maximum was 15 per 1,000 in Madras. Berar, Madras, and Ajmere-Merwara had fewer deaths and lower ratios than in 1895. In the North-Western Provinces the urban death-rate was higher than the rural, in Madras it was the same as the rural, while in all the other provinces it was, according to expectation, lower than the rural.

The following table may be consulted not only for this, but also for the succeeding paragraphs dealing with fevers:—

Statement shewing the deaths from Fevers registered in the different Provinces by Months during the year 1896.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1896.	Total. 1895.	Ratio of Deaths per 1,000 of Population. 1896.	Ratio of Deaths per 1,000 of Population. 1895.
Bengal	149,889	158,625	201,596	150,627	126,154	154,749	118,055	130,923	125,900	120,694	154,761	168,252	1,760,225	1,634,254	24·77	22·99
Assam	8,212	7,394	7,789	7,067	9,251	10,282	9,011	8,054	7,773	8,429	9,173	8,912	101,347*	92,359†	20·18	18·39
North-Western Provinces and Oudh.	112,573	97,972	107,436	98,693	103,869	82,937	77,760	93,831	101,473	112,779	103,713	112,928	1,205,964	1,093,212	25·71	23·31
Punjab	61,134	36,422	30,642	26,103	29,666	28,220	25,502	27,325	32,592	33,842	31,905	30,182	393,535	392,118	19·15	19·08
Central Provinces ..	21,043	22,556	20,971	19,712	19,981	15,128	18,180	30,037	31,693	32,992	25,205	23,262	280,760	221,418	29·55	23·30
Berar	6,105	6,483	7,714	7,631	6,367	2,906	3,482	4,677	4,963	4,673	3,559	3,371	61,931	66,203	21·78	23·28
Lower Burma	4,466	3,860	3,560	3,757	3,620	3,778	4,753	5,059	4,653	4,136	4,614	5,265	51,521	48,049	11·41	10·64
Madras Presidency ..	24,067	20,581	22,557	20,242	21,265	19,057	21,566	22,325	22,315	22,365	21,209	23,220	260,769	277,337	7·97	8·26
Bombay Presidency ..	41,982	39,041	40,092	34,732	34,039	29,255	34,418	36,793	30,552	29,349	29,664	32,312	412,229	388,848	21·90	20·66
Ajmere-Merwara ..	1,180	908	945	785	730	526	565	847	765	723	700	729	9,403	11,263	17·34	20·77
Coorg	263	242	264	204	301	370	370	365	328	250	275	320	3,552	4,061	20·53	23·48
Mysore	2,900	2,956	3,495	3,149	3,251	2,789	3,017	3,004	2,911	3,263	3,721	3,252	37,708	37,168	7·79	7·67
Total ..	433,814	397,040	447,061	372,702	358,494	349,997	316,679	363,240	365,918	373,495	388,499	412,005	4,578,944	4,266,293	21·05	19·53

* Includes 15,637 deaths from *Kala Azar*. † Includes 15,894 deaths from *Kala Azar*.

Sale of Quinine at Post Offices.—In Bengal there was an increase of 3,337 parcels of quinine sold, equivalent to an increase of 1,701,870 grains. There was no constant relation between the prevalence of fever and the demand for quinine, and it was supposed that the demand was only there great where the virtues of the drug were known.

Progress in the scheme was made in Assam. From August all post offices in the Brahmaputra and Surma valleys were supplied with packages for sale, even when situated near dispensaries. Formerly quinine was sold only at post offices at a distance from dispensaries. The greatest success was attained in the Khasi and Jaintia Hills, where, owing to a great extent to the interest taken in the matter by the missionaries at work in those hills, the sales were very considerable. The agencies there employed were post offices, missionaries and the police. Arrangements have been made for selling pice packets of quinine through the agency of vaccinators from the beginning of next vaccinating season.

In the North-Western Provinces the scheme was first introduced, and that in the districts of the Meerut division, Pilibhit, and the Tarai parganas, being subsequently extended to Hamirpur and Gorakhpur. Only 260 packets were issued, but the scheme is still in its infancy.

Both the sale of quinine through the agency of lumbarders, postmasters, etc., and its gratuitous distribution through the members of the vaccination staff appear to be on trial in the Punjab, but there is as yet not much information available as to results. The Civil Surgeons of Gurdaspur and Muzaffargarh report that the gratuitous distribution is appreciated by the people. On the other hand, the Deputy Commissioner of Jhelum says that the people as a rule decline to spend their money on quinine ; and that he is opposed to gratuitous distribution on the ground that the quinine does not reach those for whom it is intended.

In Coorg the sale of 5-grain packets were introduced in January at 22 post offices, in places where there were no dispensaries. No information can be given as to results.

In Burma the scheme for the sale of 5-grain pice packets has now been working slightly over one year, and it has not, perhaps, quite achieved the success that was hoped for. The general opinion appears to be that the chief obstacle to the working of the scheme is a want of knowledge on the part of the people of the virtues of quinine, and it is only by time and by perseverance on the part of district officers that this ignorance can be removed. The distribution of vernacular handbills setting forth the advantages of quinine, and stating how and where the drug may be obtained, has been recommended. It is also proposed to provide vendors with packets at a smaller cost than at present, so as to increase their profits, and thereby their desire to sell.

The number of deaths attributed to fever in Bengal in 1896 was 1,760,225, as compared with 1,634,254 in 1895 ; and the death-rate was 24·77 against 22·99 for the preceding year, 22·14 for the five-year period, and 18·83 for the decennium 1886–95. As in previous annual reports, the Sanitary Commissioner points out that the heading " fever " covers a multitude of complaints in the mind of the village watchman, who is primarily responsible for registration, and that it is certain that numerous deaths are put down to fever which are really due to other causes ; and considers this not surprising, because it is far less trouble for the village watchman to say at the weekly muster that so many deaths occurred from fever, about which he knows there will be no special inquiry, than to return a large number of deaths from cholera and small-pox, about which experience has taught him there will be special inquiry and a call for daily returns which cause him extra trouble. Out of the 46 districts of Bengal 29 had higher mortalities than in the previous year, and all but two higher mortalities than in the decennium 1886–95. Though the year was on the whole a dry one yet it is stated that the increase of fever was natural, because the rainfall was intermittent, and the drying and wetting of the soil alternate. The heaviest mortality took place in the months of March, December, and February, in the order given, and the lightest in July, October, and September. The last four months of 1896 had decidedly lower mortalities than the corresponding months of 1895. Ten districts had ratios over 30 per 1,000, namely, in order, Jalpaiguri, Rangpur, Dinajpur, Darjeeling, Purnea, Rajshahi, Pabna, Muzaffarpur, Darbhanga, and Jessore ; and most of these belong to the notoriously unhealthy *terai*. Fourteen districts have ratios over 25 per 1,000, eleven over 20, six over 15, four over 10, and one (Puri) over 5. The rural death-rate was 25·05, the highest individual ratios of rural areas being those of Jalpaiguri and Darjeeling. The urban death-rate was, as usual, lower than the rural, being only 19·04 ; and the highest individual town ratios were those of Kumarkhali (46·22), a small town in the Nadia district, and of Roserha (37·01), a somewhat larger town in the Darbhanga district.

To the 211 admissions of the European seamen of the port of Calcutta from fever there was only one death, and that was from enteric fever. There were 31 deaths among the native floating population, giving a ratio of 1·20 per 1,000 against 0·74 in the preceding year.

Under the heading " fevers " in which the reporting agents are apt to include all diseases wherein rise of temperature is a prominent sympton, there were 101,347 deaths registered in Assam in 1896 ; and the death-rate, which was 18·39 per 1,000 in 1895, rose in 1896 to 20·18, or 4 per 1,000 in excess of the mean of the previous five years. Most deaths occurred in June and May, and fewest in April and February. All the eight months from January to August show an increase as compared with the previous year ; but, as in the case of Bengal, there was a decided diminution in the last four months. Much the highest district death-rates were those of Nowgong (36·31), where *kala azar* is very prevalent, and of Goalpara (32·98). Besides these, two districts had ratios over 25 per 1,000, one over 15, three over 10, and one (the selected areas in the Khasi and Jaintia Hills) over 5. The rural death-rate was 20·31, or excluding the hill district, 25·63 ; and the rural areas with the highest mortalities were Nowgong and Goalpara. The urban

death-rate was 14·41, the towns with the highest ratios being Mangaldai (35·77), North Lakhimpur, Barpeta, and Nowgong (25·13).

Regarding the distribution of this fatal form of fever the provincial Sanitary Commissioner writes :— Kala azar.

"During the year 15,637 deaths from *kala azar* and 85,710 deaths from 'other fevers' were "reported as against 15,894 *kala azar* deaths, and 76,465 deaths from 'other fevers' reported in 1895. "In the province as a whole 9,245 more deaths were registered from other fevers and 257 fewer deaths "from *kala azar* than in 1895. As in the previous year, very few *kala azar* deaths were registered "in the Surma Valley, in the Sibsagar and Lakhimpur districts, and in the portion of the Khasi and "Jaintia hills under registration. In the Goalpara district 298 *kala azar* deaths were reported during "the year as against 265 in 1895. In the Kamrup district, though the mortality registered under "'other fevers' was more than 50 per cent. greater than that recorded in 1895, the increase in the "number of *kala azar* deaths registered was very small, 2,244 deaths from that cause having been "registered as against 2,059 in 1895. In the Darrang district as a whole 2,471 *kala azar* deaths were "registered as against 2,477 in 1895. In the Nowgong district 10,588 *kala azar* deaths and 1,905 "deaths from 'other fevers' were registered as against 11,037 and 1753, the respective numbers "registered in 1895. In the district as a whole the registered mortality from *kala azar* was some-"what less, and that from other fevers slightly greater than it was in 1895. As noted in our last "year's report, the recorded mortality from 'other fevers' in this district was so much less than it "was before *kala azar* made its appearance, and it was also so much less than the fever mortality "recorded in neighbouring districts that, in all probability, many deaths which in former years would "have been returned as ordinary fevers were returned in 1896 as *kala azar*.

"Deaths from *kala azar* were very equally distributed throughout the year. The months of "maximum mortality were May, June, and April; and February and January were the months in "which fewest deaths were registered. However, in May, the month of maximum *kala azar* "mortality, only 10·07 per cent. of the *kala azar* deaths occurred, and 7·33 per cent. of the deaths "occurred in February, the month in which fewest *kala azar* deaths were registered. The months of "maximum mortality of 'other fevers' were June, May, and July; and fewest deaths were registered "from the same in April, September, and October. In June, in which the maximum mortality "occurred, 12·44 per cent. of the deaths were registered; and 7·17 per cent. of the deaths were "registered in each of the months of April, September and October, the months of minimum "mortality.

"It is worthy of remark that in all the registration circles of the Darrang district except in the "Mangaldai town circle, the mortality from 'other fevers' was greater than it was in 1895. The "statistics for the year seem to show that *kala azar* has gained a firm footing in all the registration "circles of the Darrang district. Up to last year the only registration areas of the district in which the "disease was prevalent were the Mangaldai town and rural circles."

Kala azar is no new disease. So far back as 1869 the attention of administrative officers had been directed to a peculiar disorder which had decimated and, in some instances, almost totally destroyed the populations of districts in the low, densely-wooded Garo Hills. The Garos themselves gave definite accounts of the invasion of their villages by the disease, and believed it to be infectious; but European medical officers were of opinion that the disease was an intense form of malarial fever, and that there was no evidence whatever to show that it was infectious.

A pamphlet, published by Dr. Kynsey, of Ceylon, which included, among other papers, a monograph by Dr. Lutz on anchylostomiasis, attracted wide notice in India in 1887. Dr. Kynsey proved that anchylostomiasis was the cause of the anæmia prevalent among coolies in Ceylon, and, as anchylostoma were found in the intestines of individuals who had died of anæmia in Assam, Dr. Eteson, in his Sanitary Report for 1887, wrote that there was little doubt that the anæmia and dropsy so prevalent among immigrants in Assam was identical with the so-called *beri-beri* of Ceylon—adopting a misuse of nomenclature which has been fruitful in confusion. At this stage, Dr. Giles was deputed to Assam to enquire into the nature of *kala azar*. Dr. Giles was of opinion that it was anchylostomiasis, complicated no doubt in many instances with the malarial fever prevalent in Assam, but essentially due to the presence in the intestine of anchylostoma.

Soon after the publication of Dr. Giles' report, Dr. Dobson showed that the anchylostomum was a very common parasite in the intestines of the apparently healthy. It had been known before the date of Dr. Dobson's researches that the anchylostomum might be present without causing any appreciable inconvenience to the host, but the establishment of the frequency of the worm's occurrence in India was mainly due to Dr. Dobson. The result of this discovery was to discredit Dr. Giles' hypothesis, and there can be little doubt that there has been a tendency to underestimate the evil which the presence of anchylostoma in the intestine is capable of inducing. In consequence, the pendulum of professional belief swung back to malaria as the cause of *kala azar*, although some medical men, among them Dr. Campbell, who had great experience of the disease, believed that *kala azar* was a paludial fever complicated in the vast majority of cases by the presence of anchylostoma in the intestine.

Owing to the prevalence and spreading of *kala azar*, Dr. Rogers was deputed in 1896 to make another investigation into its nature, and his report was completed early in 1897.

Dr. Rogers gives a useful summary of the growth of opinion regarding the etiology of *kala azar*, and details the clinical and pathological facts observed by him. After stating his own conviction regarding the nature of the disease, he concludes with his recommendations for the prevention of its further spread.

Dr. Rogers describes *kala azar* as having begun in the Garo Hills, and spread thence up the Brahmaputra Valley, along the lines of human communication, desolating villages in its track, but shewing a very distinct tendency to disappear after a variable period from the places that have suffered a visitation.

The symptoms are those of an intense malarial cachexia. Individuals of all ages suffer, but children are especially liable ; the sexes are attacked equally ; no form of occupation ensures immunity, but the very poor are most liable to suffer, and Europeans least so. Dr. Rogers says that seven Europeans have been attacked, and regarding three cases he gives particulars which are unfortunately too meagre to be of much use. Opium-eating seems to afford an almost complete protection.

The seasonal distribution of *kala azar* is almost the same as that of malarial fevers, but more extended—beginning earlier and ending later. It is prone to attack several members of the same family, and in an affected district cases of *kala azar* are more common than are cases of severe malarial cachexia in a malarious district.

Fever is an invariable accompaniment, but it is of no particular type, its only constant characteristic being a tendency to recur again and again until the sufferer dies. One peculiarity of the fever is that the patient is frequently unaware of its existence, even when the thermometer shews that a high degree of fever is present. The disease shews a varying virulency, it is never, Dr. Rogers says, fatal in less than three months, and never lasts for more than three years. Recovery is uncommon, but it is more likely to occur at the end than at the beginning of an outbreak among a community. A characteristic of the disease is a profound disorganization of the digestive functions, and the complete inability to digest vegetable food, which often leads to a craving for an animal diet. The *plasmodium malariæ* was frequently found ; but Dr. Rogers' details on this head are less complete than might have been expected. He found most of the forms "figured by "Italian authors as typical of quotidian fever," but never crescents. A constant sign is enlargement of the spleen, frequently to a very great degree. Although the liver does not appear to be quite so constantly enlarged as the spleen, it is generally enlarged in proportion to the latter organ. Pigmentation of the viscera and of the membranes of the brain appears to be invariable.

All this goes to make up a picture of severe malarial cachexia, and the impression that *kala azar* is a form of malarial disease is deepened by an analysis of twelve cases of which Dr. Rogers gives details. Of these cases only four recovered ; but, in four, death was due to intercurrent diseases. ' It will be noticed by supporters of the theory that *kala azar* is the result of a helminthiasis that in nine of the cases, including all those that were fatal, worms were present in the intestinal tract, and that in many cases, the worms were anchylostomes. At the *post mortem* examination in 25 other cases, anchylostomes were found in 21 ; few in number, it is true, but their small numbers, as well, perhaps, as their absence in four cases, may be accounted for by the administration of thymol to some of the patients during life.

How then may *kala azar* be diagnosed from ordinary severe malarial cachexia ? Dr. Rogers is of opinion that it cannot be diagnosed in the early stages, and that it is only by its peculiar distribution, its tendency to run in families, and the rapid onset of signs of extreme cachexia, that the disease can be distinguished at all. Dr. Rogers, however, repeats the statement that the natives themselves can immediately differentiate the disease from ordinary malarial fever, but, in spite of the importance of this fact, if it is a fact, he does not give any hint as to how the natives arrive at this distinction.

What is *kala azar ?* Dr. Rogers notes that like Dr. Giles he did not succeed in cultivating any micro-organism from the blood, and concludes, perhaps too hastily, that the blood does not contain any cultivable microbe. He vigorously combats Dr. Giles' statement that the disease is anchylostomiasis. In that condition a relative increase of white blood-cells is a prominent feature, whereas in *kala azar*, except when fever is present, the white blood-cells are diminished in proportion to the red cells—the condition of the blood resembling in this respect that described by many authorities as characteristic of malarial cachexia. From the discovery of plasmodia, the constant enlargement of spleen and liver, and the pigmentation of these organs and of the kidneys, Dr. Rogers is convinced that *kala azar* is due to malaria. He believes that it is an intense, contagious form of

malarial disease, and that the organisms generally accepted as the cause of malaria have, on account of continuous favouring circumstances, developed not only great disease-causing power, but the quality of infectiveness either directly or indirectly.

From Salisbury's experiment, which, owing to its quotation by Hirsch,* is well known, it would appear possible that the poison of malaria can be carried from place to place in earth, and Schellong† is of opinion that malaria-germs can be carried into a building and multiply on the walls and on the floors and in clothing ; while there are instances on record where the circumstances were such as to suggest the possibility of direct infection from man to man.‡ In spite of all this, it is the practically universal experience that malarial fevers and cachexia are not infectious, and proofs will have to be indisputable before it can be accepted that *kala azar* is at once due to malaria alone and infectious.

The proof of infectiousness of a chronic disease may obviously be supremely difficult. The facts relied upon by Dr. Rogers are the peculiar distribution of *kala azar* and the histories of its invasion of villages. These narratives are derived from the native headmen, and the validity of the evidence will be contested by opponents of Dr. Rogers' theory on the ground that, according to his own shewing, it is not possible to recognize *kala azar* in its early stages.

Dr. Rogers endeavours to fortify his position by adducing the opinion held by Dr. Jackson regarding the infectiousness of Burdwan fever, and the account commonly given in the text-books of the appearance for the first time in 1866 of malarial fevers in the Mauritius and Réunion. But the Burdwan fever was considered by nearly everyone in a position to form a reliable opinion to be malarial and non-contagious§ ; while the few who thought that it was contagious held, either that it was not primarily malarial at all, or that it was a combination of malarial and typhus fevers‖. The story of the infection of the Mauritius appears to be a medical myth.

An examination of contemporary literature¶ shews that although the inhabitants of the Mauritius had enjoyed comparative freedom from malarial fevers, cases did occur. The British troops quartered in the island were seldom attacked,** and malarial fevers were almost entirely confined to natives of India†† ; still, bilious remittent was endemic, and cases of the same nature as the pernicious intermittent which was the typical fever of the great outbreak were not unknown. The epidemic which occurred in the hot season of 1866–67 was malarial and the fever was readily controlled by quinine. The case-mortality was, therefore, not high among the troops ; and the principal sufferers were natives of India who lived in deplorable conditions of overcrowding and filth, temporarily aggravated by the privations they had to endure consequent on the high prices attending the commercial crisis of the time. The primary cause of the outbreak seems to have been the extension of cane cultivation, which led to deforestation of the island, and so removed the natural protection against excess of rain and drought. The rains of 1865 were so heavy as to cause inundations which left swamps behind them, and the following season was intensely hot and dry. Precisely similar causes were at work in Réunion (Lacaze). Confusion seems to have arisen from the application of the term "Bombay" fever which, according to Small and Power, was merely a name given to malarial fevers because they chiefly occurred among Bombay coolies. But Dr. Barraut showed that the so-called Bombay fever was produced under the same conditions that breed typhus. It was continuous, lasting from 15–20 days ; it was spread by contagion, and just as its prevalence was unaffected by season, so its course was unaffected by quinine. This fever appeared first of all in 1808 among coolies from Bombay, whence it may have been brought by them. It was introduced into Réunion from the Mauritius.

Is *kala azar* due to malaria alone ? If it is, what leads to its unusual distribution ? Is it a disease added to malaria, as scurvy may be added, which, by weakening the affected individual, renders the process of slow degradation due to malarial poisoning a quick one ?

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* *Geographical and Historical Pathology*, New Sydenham Society's translation, Vol. I, page 297.

† Quoted by Scheube, *Die Krankheiten der warmen Länder*, page 87.

‡ Scheube, *Op. cit.*, page 88, quotes certain cases which, while they suggest origin by infection, "permit of another explanation." It is apparently to one of these cases that Mannaberg alludes "as "a curiosity" in *Die Malaria-Parasiten*, page 184.

§ *Indian Annals of Medical Science*, Nos. XXXII, XXXIV and XXXV.

‖ Dr. Verchere thought the fever was primarily typhus. Dr. Jackson, that it was malarious in origin, but having acquired contagious properties was "probably typho-malarial." *Bengal Sanitary Report* for 1872, 1873 and 1874.

¶ *Lancet*, 1867 and 1868—principally the numbers of August 3rd, 1867, page 135, December 7th, 1867, page 709, and February 29th, 1868, page 297. Also Hirsch, *Op. cit.*

** Parkes' *Hygiene*, 1st edition, published 1864.

†† Small and Power in the *Army Medical Department Report*, 1866.

Or is it a progressive extension of intense malarial fever due to physical alterations in the soil-and-water-levels in Assam ? These questions remain unanswered.

The number of deaths ascribed to fevers in the North-Western Provinces and Oudh in 1896 was 1,205,964 against 1,093,212 in 1895. The death-rate was 25·71 as opposed to 23·31 in the previous year, and to the mean ratio of 24·19 for the quinquennial period antecedent to the year under review. The heaviest mortalities occurred in December, October, and January, and the lightest in July, June and August. The peculiar rise in March (See the table on page 109) followed by a fall in April, is considered by the Sanitary Commisioner to have been probably due partly to climatic causes and partly to slight scarcity antecedent to the *rabi* crops coming on the market. The mortality in each of the nine months, January to September, was higher than in 1895, but that in each of the last three months was lower. The fall in the last months of 1896 as compared with those of 1895 has already been noticed also in the cases of Bengal and Assam. The mortality, which had been high in October 1896, fell in November, and rose again in December. The fall in November has been attributed to the scantiness of the rains and their premature cessation, the rise in December indirectly to scarcity, which would diminish the chances of recovery of persons attacked by fever or pneumonia. Two of the district death-rates were over 45 per 1,000, those of Pilibhit (48·11) and Naini Tal (45·48), the latter district including the malarious *terai*. Bareilly and Hamirpur had ratios over 40 per 1,000 while five districts had ratios over 35, five over 30, twelve over 25, fifteen over 20, six over 15, and one (Partabgarh) over 5. "Speaking generally," says the Sanitary Commissioner, "it may be said that the incidence of mortality from "fevers fell much more lightly than usual on areas with a normally excessive degree of "humidity of atmosphere and high level of subsoil water, as was to be expected from the "climatic conditions of the year." The rural mortality was 25·52, the rural areas with ratios over 40 being Pilibhit, Naini Tal, Bareilly and Hamirpur. On the other hand, the urban mortality was 28·32, higher than the rural, as it was also in 1893, 1894, and 1895 ; and the highest town ratios were those of Deoband (50·02), Mau Ranipur and the Hardwar Union. Among the large towns with high rates were Ghazipur, Cawnpore, Fyzabad, Ajhudia, Farukhabad, Fatehgarh, Jhansi, Benares and Lucknow.

There was a slight increase in the fever mortality in the Punjab, the number of deaths having risen from 392,118 in 1895 to 393,535, and the ratio per 1,000 of population from 19·08 to 19·15. The ratio for the preceding quinquennium was 23·89. The months of greatest mortality were January, February and October, and those of lowest mortality July, April and August. Like the provinces already treated of, the Punjab had less mortality in each of the last three months of 1896 than in the corresponding months of 1895, but unlike them it had also in 1896 diminished mortality in April, May, June and July. The recorded very high mortality in January is considered by the Sanitary Commissioner to be due to erroneous classification, cases of pneumonia and other chest complaints being, on account of the presence of high body temperature, returned by the ignorant village reporting agents as "fever"; but he does not say why there were more than the usual number of chest complaints in January 1896. From the report of the Inspector-General of Prisons, however, a hint is obtained of the possibility that the high mortality registered in December 1895 and January 1896 may have been connected with the epidemic presence of influenza. Both officers agree, probably with justice, that the general good health of 1895 and 1896 has been due to the scanty rainfall, and consequent prevailing dryness. Three districts had ratios over 25 per 1,000, namely Kangra (29·16), Umballa (25·74), and Rawalpindi (25·20) ; ten districts ratios over 20 per 1,000 ; eleven over 15 ; 6 over 10 ; and one (Montgomery) over 5. The rural death-rate was 19·29, and the rural areas with mortalities between 25 and 30 per 1,000 were Kangra, Umballa and Rawalpindi. The urban death-rate, as usual lower than the rural, was 17·21 ; the highest individual town ratios, just over 23 per 1,000 being those of Rawalpindi, Delhi and Amritsar, and the lowest, between 9 and 10 per 1,000, those of Maghiana, Mooltan and Umballa. The contrast between the town of Umballa and the Umballa rural area is very marked.

In the Central Provinces the deaths from fevers numbered 280,760, or 59,342 more than in 1895 ; and the mortality ratio per 1,000 of population was 29·55 against 23·30 for 1895, 21·23 for the quinquennium, and 20·98 for the decennium. The months of greatest mortality were October, September and August, and those of least mortality June, July, April and May. Every month of the year had more deaths than the corresponding month of 1895. The year 1896 was characterised, according to the Sanitary Commissioner, by irregular

distribution of an average general rainfall, and by the unusually early cessation of a more than average south-west monsoon ; while in his report for 1895 he stated that in that year both the general rainfall and the monsoon rainfall were below the average. The increase of fever in 1896 may therefore have been due to its being a wetter year than 1895. Two districts had ratios over 50 per 1,000, namely, Damoh (58·11), and Saugor (51·04) ; one (Nimar) over 45 ; one (Seoni) over 40 ; four over 35 ; two over 30 ; four over 25 ; three over 20 ; two over 15 ; and one (Sambalpur) over 10. The rural mortality was 30·19, the rural areas with ratios over 50 being Damoh and Saugor, and those with ratios over 40 Nimar and Seoni. The as usual lower urban death-rate was 22·65 ; the towns with ratios above 50 per 1,000 were Rehli and Deori, and those with ratios above 40 Garhakota, Charwa and Burha.

The number of deaths from fevers in Berar was again reduced, though still high, 61,931 being registered against 66,203 in the previous year. The ratio per 1,000 of population was 21·78 against 23·28 in 1895, and against 14·8 for the quinquennium. It has been looked upon as usual for the greatest fever mortality to occur between the beginning of August and the end of October ; but in 1896 the first five months of the year gave by far the greatest number of deaths. Each of the same five months had more deaths, while each of the remaining months of 1896 had fewer deaths than the corresponding months of 1895. This unusual fever mortality during the first five months of the year is believed by the Sanitary Commissioner to be attributable to epidemic influenza. The number of deaths due to malaria in 1896 may therefore very likely have been reduced, and this is all the more probable in view of the fact that the rainfall of the year was short, especially in the third quarter. Two deaths from bubonic plague are included in the figures for October. The highest district ratio was that of Wun (33·8), two districts had ratios over 20 per 1,000, and three over 15. The rural mortality was 21·8, Wun being the only rural area with a ratio over 30. The lower urban death-rate was 21·0, and the towns with ratios over 30 were Yeotmal, Digras, Sirasgaon, Wadegaon and Pusad.

The number of deaths recorded in Madras Presidency as due to fevers was 260,769, or 16,568 less than in the previous year ; while the ratio per 1,000 of population was 7·97 against 8·26 in 1895, and against 7·9 for the quinquennium. The Sanitary Commissioner attributes the decrease to deficient monsoon in the Ceded Districts, where malarial fevers are largely prevalent. In the table given on page 109 it may be seen that the Madras ratio was much lower than that of any other of the British provincial registration areas, and such is usually the case. Deaths were greatest in number in January, December and March, and least in number in June, April and February. Each of the first four months of 1896 had more deaths, and each of the last eight months of 1896 fewer deaths, than the corresponding month of 1895 ; and in this feature Madras is nearly the same as Berar. Three districts had ratios over 15 per 1,000, namely, the Nilgiris (19·5), Kurnool (15·4) and Vizagapatam (15·3) ; three districts ratios over 10, twelve over 5, and four over 2. The rural mortality was 8·0, the Nilgiri rural area having a ratio over 20, and the rural areas of Vizagapatam and Kurnool ratios over 15. The relation between urban and rural fever mortality seems to be abnormal in Madras, as in 1893 and 1894 the former was greater than the latter, and in 1895 and 1896 the two were identical. The towns with ratios of 15 per 1,000 or over were Kampali, Karur, and Palkanda. "In the town of Madras," says the Sanitary Commissioner, "nearer approach to the normal sub-soil water level than has existed since "the exacerbation of malarial fever prevalence attracted attention, namely in 1890, has, in "my opinion, resulted in a decline of the fever rate. On this matter a special report has, "at its request, been submitted to Government." The ratio for Madras was 13·6 against the 14·2 of the previous year. "The town of Karur exhibited a heavy increase of "mortality from fever during the year, namely, 16·5 against 10·6 of 1895. In this "case the sub-soil of the town is saturated with soakage from cesspools, and, as typhoid is "a recognised disease in this town, it need not be assumed that solely malarial fever was "dealt with."

In Coorg there were 3,552 deaths ascribed to fevers, a diminution of 512 ; and the ratio per 1,000 of population was 20·53 against the 23·48 of 1895 and the 19·66 of the quinquennium. The fever mortality ratio was nearly 78 per cent. of the death-rate from all causes. The rural mortality was 21·14, and the urban 14·31. Among rural areas Mercara had the highest ratio, and among towns Fraserpet. June, July, and August were the months that had most deaths, and April, February, and October those that had fewest.

Every month of 1896, except January, March, and December, saw fewer deaths than the corresponding month of 1895.

The total of deaths from fevers registered in Bombay Presidency was 412,229, or 23,381 more than in 1895 ; and in the twelve-year period 1885–96, this number has only twice been exceeded, namely in 1892 and in 1894. The ratio per 1,000 of population was 21·90 against the 20·66 of 1895 and the 21·10 of the quinquennium. Beginning with September the figures include 2,086 deaths from plague. The heaviest mortality characterised the months of January, March, and February, and the lightest the months of June, October, and November. Each of the first seven months of 1896 had more deaths, and each of the last five months fewer deaths, than the corresponding month of 1895 ;* the difference between the two years being least in the months of June, July, and August, and greatest in January, February, and March. The diminution of fever mortality in the latter part of the year may possibly be due to the following of a year of deficient rainfall after another of the same ; but, even if the rise in the beginning of the year was due to the inclusion among fevers of chest complaints and other affections, there is no information as to why those diseases should have been more prevalent. In the case of the Punjab and Berar the cause was shown to have been influenza, but there is no mention of this disease in the Bombay Sanitary Report. Among the troops and prisoners of the Bombay administration cases of influenza were recorded, mostly in January. With regard to the Gujarat Registration District, which, like the Western and the Sind Registration Districts, had higher mortality than in 1895, and which shewed much increase in the first months of the year, little increase in the last three, "the recognised months of malaria," the Deputy Sanitary Commissioner offers the following explanation :—

"During the first nine months of the year small-pox and cholera were prevalent in an epidemic "form throughout the district, and it is possible that many deaths due to one or other of those "diseases were entered as deaths from fever. Moreover, there are many villages in which every "death is returned as due to fever, and consequently in such villages a large proportion of deaths "must be wrongly entered. It is worthy of note that during the last three months of the year, "when malarial fever is most prevalent, the returns for the two years, 1895 and 1896, correspond "fairly accurately ; while the larger divergence occurs in the latter part of the cold weather, when "deaths from chest affections are most liable to occur, and in the hot weather and first months of the "monsoon, when epidemic diseases are most prevalent."

The districts with the highest ratios, over 30 per 1,000, were Broach (33·23), Nasik (30·33), and Kaira (30·20) ; and five districts had ratios over 25, nine over 20, four over 15, and three over 10. The rural mortality was 22·50, and the rural areas with ratios over 30 per 1,000 were Broach, Nasik, Kaira. The urban mortality, 17·59, was, as usual, lower than the rural ; the towns with ratios over 30 being Barsi, Nasik, Nadiad, Dohad, Umarkot, and Shikarpur.

The number of deaths registered in Lower Burma under the heading of fevers in 1896 was 51,521 as compared with 48,049 in the previous year ; and the death-rate was 11·41 against the 10·64 of 1895 and the 10·02 of the quinquennium. The months of greatest mortality were December, August, and July, and those of least mortality March, May, and April, and in each month of 1896 there were more deaths than in the corresponding month of 1895. The mortality of 1896 from fevers is the highest recorded in the 25 years, 1872–96. No explanation of the increase is forthcoming. The highest district death-rate was that of Akyab (20·51), and the lowest that of Hanthawaddy (5·01). One district had a ratio over 20 per 1,000, two districts ratios over 15, six over 10, and nine over 5. The rural mortality was 11·87, and the urban 8·39. No rural area had a higher ratio than 21·55, and none a lower than 5·01, the areas with the highest ratios being Akyab, Tharrawaddy, Sandoway, and Prome, those with the lowest Hanthawaddy and Amherst. The maximum for towns was 21·96, and the minimum 1·47. Among the towns with high ratios were Kawkareik, Pegu, Pantanaw, Sandoway, and Ramree, and among those with low ratios Danubyu, Yandoon, Zalun, Ngathainggyaug, Thayetmyo, and Shwedaung.

Dysentery and diarrhœa.

The number of deaths attributed to dysentery and diarrhœa throughout the registration areas of India during 1896 was 240,189, a reduction of 2,343 ; and the ratio per 1,000 of population was 1·10 against 1·11 in the previous year, the number under registration having somewhat diminished in 1896. The months of greatest mortality were August,

* Each of the first nine months of 1896 had more deaths, and each of the last three months fewer than the corresponding monthly mean of the decennium 1886–95.

September, and July, and those of least mortality February, March, and January. Each of the six months February–July had more deaths, and each of the others fewer deaths, than the corresponding month of 1895.

The highest provincial death-rate was that of Berar, where also the highest district death-rate was recorded ; and the lowest that of Bengal. Leaving out Coorg, the lowest maximum district death-rate occurred in the Punjab. The Central Provinces shewed the greatest increase of ratio, and Berar the greatest decrease. Assam, the Central Provinces, Madras, and Bombay registered increased mortality, the difference in the case of Madras being very small ; while the other eight provincial areas rejoiced in lowered ratios. The only province in which the rural mortality exceeded the urban was Berar ; but no explanation of this exceptional relation is offered.

The following statement illustrates not only what has just been written, but also the succeeding paragraphs upon bowel complaints in the different provinces :—

Statement shewing the Deaths from Dysentery and Diarrhœa registered in the different Provinces by Months during the year 1896.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.		RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1896	1895.	1896.	1895.
Bengal	4,292	3,649	4,518	4,041	4,198	4,608	4,191	4,601	3,865	3,226	3,217	3,529	47 935	49,871	0·67	0·70
Assam	1,352	1,020	1,062	1,061	1,433	1,571	1,321	1,285	1,305	1,574	1,602	1,418	16,004	15,523	3·19	3·09
North-Western Provinces and Oudh.	2,627	2,049	2,230	2,669	3,301	3,166	3,544	4,591	4,729	4,331	3,583	4,038	40,858	42,778	0·87	0·91
Punjab	908	575	690	959	1,100	885	1,045	1,529	1,886	1,692	1,446	1,171	13,886	15,648	0·68	0·76
Central Provinces ..	1,312	1,356	1,317	1,934	2,080	1,957	2,866	4,539	4,181	3,288	2,582	2,470	29,882	20,316	3·15	2·14
Berar	1,212	1,033	1,593	2,114	1,473	847	1,600	2,553	2,045	1,498	950	804	17,722	24,452	6·23	8·60
Lower Burma	490	356	337	314	663	995	1,096	1,057	792	662	572	443	7,777	8,794	1·72	1·95
Madras Presidency ..	1,752	1,444	1,410	1,341	1,620	1,661	2,267	2,614	2,755	2,330	2,428	3,180	24,802	23,937	0·76	0·71
Bombay	2,325	2,050	2,033	2,277	2,913	3,138	4,631	5,440	3,471	2,804	2,421	2,543	36,046	35,348	1·92	1·88
Ajmere-Merwara ..	16	31	27	43	19	21	29	67	37	28	35	26	379	512	0·70	0·94
Coorg	20	8	10	24	42	42	46	50	32	19	15	15	323	367	1·87	2·12
Mysore	360	339	381	303	354	357	454	442	432	368	401	384	4,575	4,986	0·94	1·03
TOTAL	16,666	13,910	15,608	17,080	19,196	19,248	23,090	28,768	25,530	21,820	19,252	20,021	240,189	252,532	1·10	1·11

The number of deaths registered in Bengal under dysentery and diarrhœa in 1896 was 47,935, or 1,936 less than in the preceding year ; and the ratio per 1,000 of population was 0·67 against the 0·70 of 1895 and the 0·69 of the quinquennium. The months of greatest mortality were June, August, and March, and those of least mortality November, October, and December. Each of the seven months, February to August 1896, had more deaths, while January and each of the last four months of 1896 had fewer than the corresponding month of 1895. The maximum district ratio was 6·69 in Darjeeling, and the minimum 0·02 in Rajshahi. One district had a ratio over 5 per 1,000, two ratios over 4, one a ratio over 3, two ratios over 2, six over 1, six over 0·5, twenty-five over 0·05, and three under 0·05. The districts of Darjeeling, Howrah, Calcutta, Balasore, Puri, Hooghly, and Cuttack, though they do not stand every year exactly in the order now given, always have the highest mortality ratios. The Sanitary Commissioner, however, says :—

" The figures cannot be trusted. It is a matter of common knowledge that dysentery and diarrhœa " are prevalent diseases all over Bengal—diseases to which many persons succumb—yet the rates of " mortality returned would lead one to suppose that, except in the half-dozen districts mentioned, " dysentery and diarrhœa prevail to a slight extent only. There is reason to believe that a large " number of deaths from this cause are returned as fever by ignorant *chaukidars*, who are the recorders " of vital statistics. In the districts at the top of the list I believe it has become the custom to return " a comparatively high death-rate from this cause, which is the only explanation I can give ; for there " is no reason why dysentery and diarrhœa should be more prevalent in Howrah, Calcutta, Balasore, " Puri, Hooghly, and Cuttack than in other parts of the province."

The urban mortality (3·22) was, as in past years, enormously greater than the rural (0·54). The rural areas with the highest ratios were Darjeeling and Howrah, and the towns Bhadreswar (12·76), Serampore, Chaibassa, Howrah, Midnapore, Kurseong, and Hooghly with Chinsurah. The first, second, and last of these towns had also very high ratios in the preceding year.

In the port of Calcutta there were 61 admissions but no deaths among European seamen ; while in the native floating population there were 9 deaths, all out of hospital, or 0·35 per 1,000 of strength.

There were 16,004 deaths registered as due to dysentery and diarrhœa in Assam in 1896, an increase of 481 ; and the death-rate was 3·19 per 1,000 against 3·09, the death-rate of the previous year, and against 2·94, the quinquennial mean death-rate. The months of greatest mortality were November, October, and June, and those of least mortality February, April, and March. April, September, November, and December had fewer deaths than the corresponding months of 1895 ; the other months, more deaths. In accordance with past experience, the district with the highest death-rate was Lakhimpur (7·16), and that with the lowest Goalpara (0·63). One district had a ratio over 7 per 1,000, two ratios over 4, three ratios over 3, one a ratio over 2, one a ratio over 1, and one a ratio over 0·5. The rural mortality was 3·12 and the urban 6·25. Lakhimpur and Cachar were the rural areas with the highest ratios, and Mangaldai and Golaghat the towns.

The total number of deaths ascribed to dysentery and diarrhœa in the North-Western Provinces and Oudh in 1896 was 40,858, a reduction of 1,920 ; and the death-rate was 0·87 against the 0·91 of 1895 and the 1·00 of the quinquennium. The months of greatest mortality were September, August, and October, and those of least mortality February, March, and January. The six months, January–June, had fewer deaths, the four months, July–October more deaths, November fewer deaths, and December more deaths than the corresponding months of 1895. The provincial Sanitary Commissioner considers the rise in December to have been due partly to climatic causes and partly to scarcity. The hill tracts, as usual, showed high rates. The highest district ratio (8·9) was that of Garhwal, and the lowest (0·05) that of Ballia and of Jaunpur. One district had a ratio over 8 per 1,000, two over 5, one over 4, three over 2, nine over 1, five over 0·5, and twenty-seven of 0·05 or over. The rural mortality was 0·76, the urban 2·40 ; the rural areas with the highest ratios being Garhwal and Jhansi, the towns Hardoi (40·89), Kashipur (16·37), Lalitpur and Rath. At Hardoi a heavy mortality occurred among the famine-stricken inhabitants of the poor-house ; while Kashipur, a town in the Naini Tal district, is said to be noted for the frequent occurrence of dysentery and diarrhœa.

There were 13,886 deaths attributed to dysentery and diarrhœa in the Punjab, a reduction of 1,762 ; and the ratio per 1,000 of the population was 0·68 against 0·76 in the previous year, and 0·81, the quinquennial mean. The heaviest mortalities occurred in the months of September, October, and August, and the lightest in February, March, and June. February, March, August, and September had more deaths, all the other months fewer deaths, than the corresponding months of 1895. "The year taken as a "whole," says the provincial Sanitary Commissioner, "has shown a death-rate considerably "below the mean for the ten preceding years, a fact which I am inclined to ascribe to the "dry season we experienced in 1896, especially as the worst months in 1895 also shew a "mortality considerably below the mean, that year being also an unusually dry one." The highest district ratio was that of Simla (3·26) and the lowest that of Hazara (0·11). One district had a ratio over 3, five a ratio of 1 or over 1, thirteen ratios over 0·5, and twelve ratios over 0·05. It is said to be usual for the death-rates of the districts of Simla, Gurgaon, Kangra, Delhi, Gurdaspur, Umballa, Karnal, and Hissar to be comparatively high. The rural mortality was 0·58, the urban 2·0 ; the rural area with the highest ratio being Simla, and the towns with the highest ratios Pind Dadan Khan, Bhiwani, Kaithal, and Rewari.

The number of deaths registered under dysentery and diarrhœa in the Central Provinces was 29,882, an increase of 9,566 ; and the death-rate per 1,000 of population was 3·15 against the 2·14 of 1895 and the 1·84 of the quinquennium. The months of greatest mortality were August, September, and October, and those of least mortality January, March, and February. Each month of the year 1896 saw the occurrence of more deaths than the corresponding month of 1895. The monsoon rainfall was irregularly distributed, and ceased very early ; the crops were below the average ; there was widespread distress and scarcity ; and the increase of bowel complaints was due to insufficiency of the usual food, and to the consequent ingestion of unsuitable food-stuffs. The highest district ratios were those of Jubbulpore (9·79), Damoh, Murwara, and Mandla (7·68), and the lowest district ratio that of Bhandara (0·25). Three districts had ratios over 9 per 1,000, one over 7,

two over 4, three over 3, two over 2, eight over 1, and one over 0·05. The rural death-rate was 2·75 against 2·04 in the previous year; the rural areas with the highest ratios being Jubbulpore, Mandla, Damoh, and Murwara. The urban mortality was 7·44 against 3·19 in 1895; and with regard to individual towns, Damoh had a ratio over 70 per 1,000, Murwara over 60, Khurai over 40, Sehora over 30, Narsinghpur, Lakhnadan, Hatta, and Jubbulpore over 20; Gadarwara, Burha, Mandla, and Mungeli over 10.

The total number of deaths registered as due to dysentery and diarrhœa in Berar in 1896 was 17,722, a reduction of 6,730; and the death-rate was 6·23 per 1,000, as compared with 8·60 in the previous year, and with 6·1, the mean death-rate of the previous five years. The heaviest mortalities occurred in the months of August, April, and September, and the lightest in the months of December, June, and November. Each of the first four months of 1896 had more, and each of the other months fewer, deaths than the corresponding month of 1895. The highest district death-rate was that of Ellichpur (10·3), and the lowest that of Wun (2·7); and this relation is a usual one. The other districts had ratios of 8, of over 6, and of over 5. The rural mortality was 6·5, and the urban 4·5; and in at least the three preceding years also the rural ratio was higher than the urban. No explanation is given as to why Berar differs in this point from other provinces. Among rural areas Ellichpur had the highest ratio, and among towns the highest ratios were those of Nandura, Karajgaon, Bulgaon, and Ner Pinglai.

The total number of deaths registered under dysentery and diarrhœa in Madras Presidency in 1896 was 24,802, an increase of 865; and the death-rate was 0·76, or 0·05 more than in 1895, and 0·04 less than the mean of the five years preceding. The months of greatest mortality were December, September, and August, and those of least mortality April, March, and February. The first six months of the year and August had each fewer deaths, the other months each more deaths, than the corresponding month of 1895. The increase in the second half of the year, and especially in December, is probably connected with the prevalence of cholera. The highest district ratio was that of Madras (5·3), and the lowest that of Kurnool (0·2). One district had a ratio over 5, one over 2, three over 1, eleven of or over 0·5, and six over 0·05. The rural mortality was 0·5, and the urban 3·2. With regard to Chingleput, which had the highest ratio among rural areas, the Sanitary Commissioner says:—

"This district is notorious for bowel affections. The increase may be due to a better rainfall in "certain parts of the district than it has had for some years past bringing about access of water to tanks "from more than usually distant parts, and with it filth that would have been out of range of influ- "ence in ordinary years, or to fluctuation of the sub-soil water beyond normal limits. It is probable "that much of the so-called dysentery and diarrhœa of South Canara and Malabar is due to catarrhal "inflammation of the intestines following exposure to wet, which must form a prominent feature of "the every-day life of the labourer in these districts."

Over 7 per 1,000 was the ratio of the town of Coonoor, and over 6 per 1,000 the ratios of Tanjore, Vizagapatam, Calicut, and Tuticorin.

During 1896 the number of deaths under dysentery and diarrhœa in Coorg fell only from 367 to 323, thus remaining much higher than in 1894 and 1893. The ratio of 1896 was 1·87, that of 1895 2·12, and that of the quinquennium 1·38. In August and July the deaths were most, and in February and March least, numerous. January, April, and August were the only months of 1896 that had more deaths than the corresponding months of 1895, and in April the difference was very slight. The rural mortality was 1·42, and the urban 6·38. Among rural areas Kiggatnad had the highest ratio (2·33), and among towns Virajendrapet (17·32).

During 1896 the number of deaths from dysentery and diarrhœa in Bombay Presidency was 36,046, an increase of 698; and the ratio per 1,000 of population was 1·92 against the 1·88 of 1895 and the 1·87 of the quinquennium. The months of greatest mortality were August and July, and the months of least mortality March and February. Each of the first eight months of 1896 had more, and each of the last four months fewer, deaths than the corresponding month of 1895. The central registration district only had a decrease of ratio, the other four shewing an increase. The highest district death-rate was that of Nasik (4·73), and the lowest that of Upper Sind Frontier (0·05). One district had a ratio over four per 1,000, three districts ratios over 3, six over 2, four over 1, and ten of or over 0·05. The rural mortality was 1·86, the rural areas with the highest ratios being Nasik and Belgaum, and those with the lowest Panch Mahals and Hyderabad. Greater was the urban death-rate, namely, 2·33; and the towns with the highest ratios were Nandurbar, Nasik, Chopda, and Ahmednagar.

In Lower Burma the number of deaths registered from dysentery and diarrhœa was 7,777, or 1,017 less than the number of the previous year, which was, chiefly on account of improved registration, the highest number ever recorded. The ratio per thousand of population was 1·72 for 1896, 1·95 for 1895, and 1·43 for the quinquennium. Deaths were most numerous in July, August and June, and least so in April, March and February. May, September, October, and November, had each more deaths, and the other months each fewer deaths, than the corresponding month of 1895; but the difference in May and June was very small. The highest district ratio was that of Tavoy (4·84), and the lowest that of Prome and of Henzada (0·63). One district had a ratio over 4 per 1,000, three districts ratios over 3, two over 2, nine over 1, and three over 0·5. The rural mortality was 1·62, and the urban 2·38. The rural areas with the highest death-rates were Tavoy, Bassein, and Myaungmya. Some of the towns had high ratios, such as Thaton, Maubin, Ramree, Bassein, and Myanaung; others, such as Kyangin, Zalun, Thayetmyo, etc., had very low mortalities; while two recorded no deaths at all. With regard to these differences the Sanitary Commissioner remarks :—

"Some of these towns get their water-supply from rivers; some partly from rivers, partly from "wells; and some have to rely on wells entirely. No relation between these various sources of supply "and the incidence of bowel complaints is discernible, nor can any be traced in the sanitary defects "or meteorology."

Injuries. The deaths recorded under "Injuries" during 1896 numbered 92,531, or 2,029 less than in the preceding year; but as the population under registration also fell, the ratio 10·43 per 1,000 remained unchanged. The whole reduction took place in five provinces, there having been more or less increase in seven. The ratio of mortality ranged from 0·67 in the Central Provinces to 0·23 in Lower Burma. As in the previous year, the months that saw most deaths from injury were July and August.

Statement shewing details of deaths from Injuries registered in the different Provinces during the year 1896.

Province.	Population under registration.	Details of Deaths from Injuries.				Total.
		Suicide.	Wounding.	Accident.	Snake-bite or killed by wild beasts.	
Bengal	71,070,233	3,456	1,628	12,729	10,609	28,422
Assam	5,021,084	107	133	1,097	255	1,592
N.W. Provinces and Oudh...	46,904,791	3,480	1,760	16,253	6,960	28,453
Punjab	20,553,982	376	680	4,725	1,312	7,093
Central Provinces	9,501,401	1,161	825	3,022	1,383	6,391
Berar...	2,843,222	163	56	536	168	923
Lower Burma	4,514,773	70	188	265	505	1,028
Madras Presidency... ...	32,721,267	1,867	6,612		2,343	10,822
Bombay „	18,820,346	684	633	3,538	1,383	6,238
Ajmere-Merwara	542,358	9	13	203	55	280
Coorg...	173,055	7	7	39	3	56
Mysore	4,843,523	104	927		202	1,233
Total	217,510,035	11,484	55,869		25,178	92,531

All other causes. The number of deaths recorded under "All Other Causes" was 1,358,260 against 1,282,141; and all the provincial registration areas, except Berar, Coorg, and Mysore, shared in the increase. As in the preceding year, the greatest monthly record under this heading was in December.

Vaccination.

The total number of vaccinations performed in 1896–97 by all agencies among the civil population throughout British India was 8,019,856, as compared with 7,912,086 in 1895–96. Of the total, 7,385,791, were primary operations, of which 6,936,842 succeeded, and 634,045 were re-vaccinations, of which 388,251 proved successful. Notwithstanding the general increase, there was a falling off in some provinces, either in the number of primary operations, or in the number of re-vaccinations, or in the numbers of both, the total diminution being most marked in the Punjab and the Central Provinces.

As usual, the average number of vaccinations performed by vaccinators was highest in the Punjab and lowest in Bengal. In the vaccinations performed by the special establishments, the percentage of success in primary cases varied between 92·01 in Lower Burma, and 98·62 in Bengal, and in re-vaccinations between 20·5 in Berar, and 94·25 in Assam. In the operations performed by the dispensary establishments the ratio of success in primary cases was highest, 96·04 per cent. in Bengal, and lowest, 52·07 in Coorg ; and in re-vaccinations it ranged from 19·02 per cent. in the North-Western Provinces and Oudh, to 76·35 in Assam.

The state of infant vaccination is still backward in Bengal, Assam, Madras, Coorg and Upper Burma, but the number of infants protected were, in every province except Assam, the Punjab and the Central Provinces, greater than in 1895–96. The total number of children under one year of age, who were successfully vaccinated was 2,903,167, and of those between one year and six years of age 3,237,849, against 2,751,764 and 3,372,925, respectively, in the preceding year. The proportion of persons successfully vaccinated per thousand of population was everywhere greater than in 1895-96, except in the Punjab, the Central Provinces, Bombay, and Coorg.

The following comparative statement shews in outline the work of the Vaccination Departments during 1895-96 and 1896-97 :—

Comparative statement of vaccination in the different Provinces of India, excluding Ajmere-Merwara, in 1895-96 *and* 1896-97, *together with the death-rates from Small-pox during* 1895 *and* 1896.

Province.		Population.	Number of vaccinations performed.			Percentage of successful cases.		Persons successfully vaccinated per 1,000 of population.	Ratio of deaths from small-pox per 1,000 of population during the calendar years 1895 and 1896.	Average number of vaccinators employed in Department.*	Average number of operations per vaccinator.*
			Primary.	Re-vaccinations.	Total.	Primary.	Re-vaccinations.				
Bengal	1895-96	70,761,383	2,227,932	49,149	2,277,081	97·84	41·85	31·09	0·18	3,380	639
	1896-97	71,053,516	2,223,128	70,527	2,293,655	97·92	52·60	31·16	0·18	3,478	622
Assam	1895-96	5,634,258	237,119	7,149	244,268	97·63	87·62	42·20	0·77	228	1.025
	1896-97	5,634,258	250,897	7,525	258,422	97·47	93·10	44·65	1·09	227	1,103
North Western Provinces and Oudh	1895-96	47,146,033	1,437,790	61,463	1,499,253	90·89	59·19	28·49	0·04	854	1,754
	1896-97	47,146,033	1,443,731	84,747	1,528,478	90·72	61·89	28·89	0·91	878	2,740
Punjab	1895-96	20,724,940	693,744	229,431	923,175	93·10	56·72	37·44	0·41	300	3,066
	1896-97	20,724,940	673,078	229,335	902,413	93·22	59·76	36·89	2·19	303	2,959
Central Provinces	1895-96	12,173,345	397,261	68,214	465,475	96·22	81·97	35·99	0·70	257	1,740
	1896-97	12,228,289	367,821	45,988	413,809	95·99	77·48	31·79	0·82	260	1,519
Berar	1895-96	2,897,040	92,694	13,911	106,605	95·92	23·43	31·81	0·2	44	2,423
	1896-97	2,897,040	98,594	21,717	120,311	96·89	20·55	34·51	0·3	44	2,729
Lower Burma	1895-96	4,658,627	216,759	28,306	245,065	91·22	45·74	45·22	0·34	123	1,974
	1896-97	4,658,627	268,881	24,011	292,892	92·03	57·15	56·06	0·37	110	2,622
Upper Burma	1895-96	3,488,228	118,513	2,135	120,678	92·63	67·73	31·89	—	54	2,143
	1896-97	3,488,228	127,251	3,105	130,356	93·22	64·67	34·58	—	51	2,480
Madras	1895-96	35,651,577	1,120,625	77,546	1,198,171	91·22	75·24	30·31	0·1	842	1,383
	1896-97	35,651,577	1,173,131	74,589	1,247,720	90·56	74·73	31·36	0·3	834	1,465
Bombay	1895-96	22,701,942	730,108	75,216	805,324	93·09	57·80	31·85	0·12	434	1,854
	1896-97	22,701,942	734,237	70,750	804,987	92·18	58·86	31·65	0·34	437	1,834
Coorg	1895-96	173,055	9,173	1,840	11,013	94·05	81·52	58·52	0·04	9	1,157
	1896-97	173,055	9,080	1,431	10,511	95·02	82·95	56·72	0·1	9	1,112
Total	1895-96	226,010,428	7,281,748	614,360	7,896,108	94·12	60·26	31·96	0·20†	—	—
	1896-97	226,357,505	7,369,829	633,725	8,003,554	94·12	61·26	32·36	0·62†	—	—

* Refers to special vaccination establishments only.
† Calculated on figures taken from Sanitary Reports excluding Upper Burma.

Animal vaccination.—In the paragraphs dealing with the various provinces details will be found regarding the different kinds of vaccine material in use. It will be observed that bovine vaccination is making steady progress. The calf lymph is used either direct from the vaccinifer or kept without admixture for a very short time before use. For preserving stocks and for the distribution of vaccine, the lymph is made into pastes with glycerine, or lanoline,

or vaseline. The vaseline paste, to which special attention was directed in last year's report, was introduced into the Punjab by Drs. Roe and Bamber, but its use has not proved quite so successful as was expected. It may be noted that a vaseline preparation was tried and discarded by Dr. Little in Berar so far back as 1889.

In connection with the preservation of calf lymph, reference must be made to a very important recently published article* by Drs. S. Monckton Copeman and F. R. Blaxall.

In 1891 Dr. Copéman presented a paper to the International Congress of Hygiene, in which he called attention to the purification from extraneous organisms that vaccine lymph underwent after storage for several weeks with a mixture of chemically pure glycerine and distilled water. Since then several observers have confirmed this result. In accordance with a suggestion contained in Section 448 of the Report by the Royal Commission on Vaccination, Dr. Copeman made arrangements with Dr. Blaxall to carry out a series of experiments to elucidate more fully the comparative merits of the glycerine method and other methods for the purification and preservation of animal lymph. Dr. Blaxall investigated the action on vaccine material of glycerine, lanoline, and vaseline, and found that, while extraneous microbes were killed after storage of the lymph with glycerine, their numbers were largely increased after storage with lanoline and vaseline. He found further that lymph taken from calves that had been vaccinated with vaccine rendered free from extraneous microbes by glycerine storage, was often remarkably free from extraneous micro-organisms. In his experiments Dr. Blaxall made use of Price's "Pure Glycerine" of a specific gravity of 1·260; it was thoroughly mixed with sterilized distilled water to 50 per cent. by weight, and the mixture was sterilized. Four parts by weight of the sterilized mixture were added to one part of the vaccine material and stored for a month, when it was found to be free from extraneous organisms.

In commenting on the experiments, Dr. Copeman lays stress on certain precautions that should be taken in the preparation of the glycerine emulsion. Chemically pure glycerine should be used and should be mixed with distilled water. The mixture should be sterilized before being added to the vaccine material, and it should be added in a definite proportion. Dr. Blaxall used 4 to 1, but a much higher dilution, 15, and even 20, to 1 by weight, was used successfully by the German Commission of 1896. Lastly, the emulsion should be protected from light and air.†

In India we have to contend not only with adventitious organisms, but frequently with the effect of great heat in destroying the specific action of the vaccine. While some prefer glycerine-vaccine to lanoline-lymph-paste, complaints of ill effects produced by the latter have not been numerous, and it would be possible to make too much of the theoretical advantage enjoyed by the glycerine preparation. Still the advantage is undoubted, and it seems very necessary that experiments should be undertaken to ascertain the effects of diluted glycerine on the bacterial flora of Indian lymph, as well as to obtain more precise data than have been recorded hitherto regarding (*a*) the "age" at which vesicles yield the most effective lymph in different conditions; (*b*) the proportions of glycerine and water and lymph which give the best result; and (*c*) the effect of heat on the keeping qualities of the emulsion.

During the year 1896–97, the inspecting staff in Bengal consisted of the Sanitary Commissioner and his three Deputies, 48 Civil Surgeons, 207 Native Inspectors and 13 Head Vaccinators; and the operating staff of 140 vaccinators paid by Government, 60 paid by District Boards, 253 in the employment of municipalities or attached to dispensaries, and 3,278 men who receive no salary but are licensed by Government to vaccinate for fees. As compared with the previous year there was a decrease of 4 Inspectors and of 40 salaried vaccinators, and an increase of 44 licensed vaccinators and 76 apprentices.

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* Report of the Medical Officer of the Local Government Board for the Year 1895–96, Appendix C.

† Since this was in type, the report of the Medical Officer of the Local Government Board for 1896–97 has been received. It contains (No. 6) a report by Drs. Thorne Thorne and Monckton Copeman on glycerinated calf lymph. The reporters visited Paris, Brussels, Berlin, Dresden, Cologne and Geneva. In Paris alone did they find vaccination carried on under official sanction with crude calf lymph, and even there the process was limited to vaccination direct from calf-to-arm—and this only to convince certain classes that the lymph used was derived from the calf; all lymph stored for distribution being glycerinated. In Germany they were informed that the system of vaccinating direct from the calf had come to be abandoned as completely as from arm-to-arm; the use of glycerinated calf lymph having become general throughout the Empire.

In the French army from the 1st November 1897, the exclusive use of animal lymph has been prescribed, and it is to be supplied from five depôts in Paris, Lyons, Chalons, Bordeaux and Algiers. It is mixed with glycerine. *Hygienische Rundschau* No. 1, 1898, p. 48.

The total number of operations performed by all agencies throughout the province was 2,293,655—an increase of 16,574, which is the more satisfactory when the difficulties which the department had to encounter during the year are considered. There was an increase in the work done in 26 districts; most noticeable in Backergunge, Cuttack, Chittagong, Shahabad and Bankura; and a decrease in 23. The greatest falling off in the number of operations was in Saran, where high prices of food-grains left the people no money to pay the licensed vaccinators. The same causes were at work in most of the districts, and in some of them the public health was very bad. In Faridpur the decrease as compared with 1895–96 is attributable to the exceptional amount of work done in that year when vaccination was accepted by the Ferazi Mahomedans; and the apparent falling off in Mymensingh was also due to an unusual number of operations having been performed in the previous year when small-pox was epidemic in the district.

The ratio of success in primary operations was 98·50, or 0·11 per cent. higher than in 1895–96. The high percentage recorded unfortunately does not represent the facts and is due to the dishonest practice of the vaccinators, who, in many cases, do not enter the names of the children they have operated upon until the vaccination is successful, and frequently reckon as successful, partial, and even absolute, failures. The number of re-vaccinations was 70,527, of which 60·23 per cent. succeeded, the high ratio being accounted for by the fact that in many cases the operation was repeated until it was successful. It is satisfactory to notice that, in spite of the scarcity, the improvement in the protection of infants was more than maintained. Estimating the number of infants available at 40 per thousand of the census population, 17·6 per cent. were successfully vaccinated in 1896–97 against 14·7 in 1895–96, and a mean of 12·8 in the preceding three years.

Of the various agencies employed, only the vaccinators paid by District Boards and Municipalities did more work than in the previous year, the average number of operations performed by each man having been 979 against 881. The licensed vaccinators performed on an average only 621 operations, or 20 less than in 1895–96, but they were, as already explained, specially affected by the poverty of the people. The vaccinators paid by Government vaccinated on an average only 441 against 481 in the previous year, the falling off being due to disappointment felt by them when they learned, towards the end of the year, that the districts in which they worked were to be thrown open to licensed men. The Deputy Sanitary Commissioners verified only 0·45 per cent. of the total operations, because, during the working season, from October until the end of March, they were employed on plague duty. All other inspecting officers verified larger numbers than in the preceding year; Civil Surgeons 9·56 per cent. against 8·80; District Inspectors 38·47 per cent., against 32·77, and Sub-Inspectors 65·34 per cent. against 62·52. The Civil Surgeon of Dacca verified 13,626 cases, the Civil Surgeon of Darbangha (Dr. E. H. Brown) 13,581, and the Civil Surgeon of Backergunge (Dr. K. P. Gupta) 13,288; four Civil Surgeons* inspected more than 10,000 operations, and thirteen others from 5,000 to 10,000. The percentages of operations inspected and found successful were, by Deputy Sanitary Commissioners, 84·71, by Civil Surgeons, 95·56, by District Inspectors, 96·93, and by Sub-Inspectors, 97·14.

Vaccination was carried on as usual with fresh calf lymph, calf lymph mixed with lanoline, and humanized lymph. There was a considerable increase in the amount of lanoline lymph paste manufactured in Calcutta and a slight decrease owing to difficulty in getting calves in Darjeeling. The use of calf lymph, fresh and prepared, is extending rapidly—so rapidly that Dr. Dyson believes that its use will soon supersede arm-to-arm vaccination in Bengal. There was also a considerable demand for lanoline lymph from Nepal, and 1,845 grains were supplied.

Excluding the staffs of dispensaries and the employés of tea-garden proprietors, there were employed on the work of vaccination in Assam, 18 Native Inspectors, 175 vaccinators paid by Government, 28 licensed men and 6 apprentices. The total number of operations performed rose from 233,812 in 1895–96, to 250,350, and the average number performed by each vaccinator from 1,025 to 1,103. Of the total 243,307 were primary vaccinations and 7,043 were re-vaccinations, the percentages of success claimed being 97·58 and 94·25, respectively, as compared with 97·74 and 87·98 in the previous year. The ratio of success in primary operations, although slightly lower than in 1895–96, is still very high. It has been ascertained by special enquiries made by Civil

*Including those mentioned.

Surgeons that vaccinators are not in the habit of excluding unsuccessful cases from their returns, and the Sanitary Commissioner records it as his opinion that the high rate of success is due to the excellent quality of the lymph supplied from the depôt at Shillong. The very high and increasing ratio of success in re-vaccinations, regarding which no attempt at explanation is made, would itself cast doubt upon the accuracy of the reported results even if an examination of the district returns revealed no suspicious figures. For instance, in the district of Nowgong, there were 12,970 primary operations performed by the special staff, and every single operation is stated to have been successful! Even if it is admitted that real insusceptibility to vaccination does not exist—and the vaccinators of the Local Government Board did not meet with a single instance during fifteen years in upwards of 95,000 consecutive primary vaccinations—still, in the absence of the highest skill, "insusceptibility" does occur. In England in 1893, the returns from the provinces showed 3·4 per thousand of the children born to be insusceptible, and the figure in the metropolitan returns was 5·3. Moreover, in Nowgong itself, of 237 primary operations performed by the dispensary staff, only 91·56 per cent. succeeded. There was again a marked diminution in the number of operations performed by Civil Surgeons and dispensary staffs; the numbers have fallen from 12,302 in 1894–95 to 10,456 in 1895–96 and to 8,072 in 1896–97. Of these, 7,590 were primary operations, and 482 re-vaccinations, with ratios of success of 94·26 and 76·35 per cent. respectively, as compared with 95·08 and 82·26 in 1895–96. By the tea-garden agencies 16,274 operations, all of which were primary, were performed, and 82·79 per cent. proved successful. In certain gardens at Mazdu, Ghilacherra and Jagcherra in the Sylhet District, the results were most unsatisfactory, for out of 2,398 vaccinations performed during the year only 103 succeeded.

The number of infants protected was 20·4 per cent. of the total number of births, estimated at 40 per 1,000 of the census population, against 20·9 in 1895–96, and 17·6 the mean of the previous three years.

Of the total number of operations performed, the results of 7·98 per cent. were inspected by Civil Surgeons who found 98·38 of the cases successful; 60·90 per cent. were verified by Native Inspectors and 97·68 found successful. In ten towns, with an aggregate population of 66,313, where vaccination is compulsory under the law, 4,222 operations were performed, of which 3,685 succeeded; 618 notices were issued under the Act, but not a single person was prosecuted.

Inoculation is still practised in Sylhet, Silchar and Lakhimpur and in the Garo Hills. The Civil Surgeon of Sylhet reported "that there was reason to believe that an outbreak "of small-pox in Burunga village in the North Sylhet sub-division was due to "inoculation."

The working of the Bovine vaccine depôt at Shillong was satisfactory, and the lymph supplied from it during the year was reported by all Civil Surgeons to be excellent. Certain experiments were made by six Civil Surgeons with calf lymph mixed with glycerine and with lanoline lymph paste. The results obtained with the two preparations were practically the same. The Sanitary Commissioner, however, prefers the glycerinated lymph as it keeps better; not on account of any quality inherent in the preparation, but because it is distributed and stored in hermetically sealed tubes.

In the North-Western Provinces and Oudh the supervising staff consisted of two Deputy Sanitary Commissioners, 48 Civil Surgeons and 49 Assistant Superintendents, and the average number of operators was 878. In spite of scarcity, of the cessation of the operating season fifteen days earlier than in past years, and of the employment of a very considerable number of vaccinators at relief works in connection with cholera, and on plague duty, the total number of operations rose from 1,497,899 in 1895–96, to 1,527,308. Of these, 1,442,743 were primary operations, and 94·65 per cent. succeeded; of the 84,565 re-vaccinations, 68·77 succeeded. The number of vaccinations per man fell from 1,754 to 1,739. In addition to the work of the regular staff, 988 primary operations and 185 re-vaccinations, of which 92·82 per cent. of the former and 19·02 per cent. of the latter proved successful, were performed at dispensaries. The number of infants protected during the year was again higher than in the preceding year, and rose from 570,227 in 1895-96, to 578,390. The interest taken in vaccination in the different municipalities appears to vary considerably, but in many instances the Civil Surgeons, who are Superintendents of Vaccination in the municipalities, were occupied with other important work.

The number of inspections made by supervising officers was somewhat less than in the preceding year; the percentage of the total verified by Deputy Sanitary Commissioners

and Civil Surgeons was 9·05, against 9·6 in 1895–96; and by Assistant Superintendents 27·77 per cent. as compared with 29·83. The percentage found by the former to be successful was 94·01, and by the latter 93·17.

During the year, the question of the entertainment of estate vaccinators was taken up. It was arranged that each estate large enough to afford employment for a vaccinator should pay for one; smaller estates, in a position afford it, to join with one or more others to pay for a vaccinator or to give contributions in cash to the cost of district vaccinators.

The supply of lymph from the hills was sufficient and satisfactory.

In the Punjab the supervising staff comprised one Deputy Sanitary Commissioner, six Divisional Inspectors and 34 Native Supervisors. Besides these, Civil Surgeons exercised general supervision in their districts, and carried on inspections during their tours. The average number of vaccinators, including the special staff and men entertained by Cantonment Committees, was 303, or three more than in 1895–96; but, while the number of operators was slightly increased, the number of operations performed was much less than in the previous year—the falling off amounting to 20,666 primary operations, and 96 re-vaccinations. The circumstances brought forward by the Sanitary Commissioner as leading to the diminution of work done are not considered by the Local Government to be the real causes. Stricter supervision on the part of inspecting officers may, however, have something to do with it, for the decrease in work is due entirely to a diminished outturn by the district staff. They performed 596,686 primary operations, 28,210 less than in 1895–96, and 188,777 re-vaccinations, or 16,055 fewer than in the previous year. Meanwhile the special staff performed 67,780 primary operations, or 6,072 more than in the preceding year, while the number of re-vaccinations performed by them was 34,113, or almost double the figure of 1895–96. The dispensary establishments vaccinated 3,737 persons primarily, and re-vaccinated 2,227, against 2,282 and 987, respectively, in the preceding year. The cantonment vaccinators performed 4,875 primary operations and 4,218 re-vaccinations against 4,858 and 6,015, respectively. The percentage of success in primary operations attained by the district staff was 93·97, against 93·36 in the previous year; by the special staff 86·93, against 90·29; by dispensary establishments 89·11 per cent., against 93·38; and by cantonment vaccinators 91·92, against 94·77. The percentage of success in re-vaccinations attended by the district staff was 59·19, and by the special staff 61·84.

Among Native States, Patiala headed the list with 92,509 operations, but here again there was a falling off of 6,336 in the total performed, although the ratios of success, 95·46 in primary cases and 47·63 in re-vaccinations, were considerably higher than in the previous year.

The number of infants protected was 58·5 per cent. of the estimated number of births, against 58·8 per cent. in 1895–96. Civil Surgeons inspected 9·86 of the primary operations and 4·98 per cent. of the re-vaccinations; native Supervisors 57·43 per cent. of the primary operations and 31·01 per cent. of the re-vaccinations; Divisional Inspectors 15·56 and 9·31 per cent., respectively. The percentages of success found by the various inspecting officers were in almost all instances, except in the comparatively small number of re-vaccinations verified by the Divisional Inspectors, much higher than those claimed by the vaccinators.

The vast majority of the operations were performed with calf lymph without admixture, and the ratio of success attained in primary operations was very high,—99·1 per cent. *Humanized lymph* was used in 42,825 primary operations, and 98·8 were successful. *Vaseline lymph* was used in 70,199 cases and only 92·6 succeeded. But although vaseline lymph was less efficacious in primary cases, it was most efficient in the large number of 22,009 re-vaccinations performed, of which no less than 81·0 per cent. succeeded, against 75·2 per cent. of re-vaccinations with fresh calf lymph, and 71·0 per cent. with humanized lymph.

Vaseline lymph was on its trial during the year, and the officiating Deputy Sanitary Commissioner in his report states that the results obtained with it fully justify the hopes entertained of it. It seems, however, impossible to agree with this opinion, for not only was the percentage of success attained in primary cases lower than where other kinds of lymph were used, but the marks resulting from the vaccination were not satisfactory. The fact that the marks are not pitted probably signifies only that the inflammation was so great that the septa were broken down; but a high degree of inflammation, even if it does not interfere with the efficacy of the prophylactic, is very undesirable in itself. Moreover, it will be remembered that the mortality of persons attacked by small-pox who

have good marks of vaccination is much less than half that of persons on whom the marks are, from whatever cause, imperfect. While it is, of course, common enough for the patient to develope a nasty sore from the introduction of extraneous organisms when scratching, it appears that the vaseline vaccine is highly putrescible, for in accounting for numerous failures it is stated that "vaseline lymph is a putrescible substance and unless all instruments introduced into the tube are properly sterilized each time, decomposition is readily set up, and the lymph becomes bad."

In the figures from the Central Provinces the feudatory states of Bamra and Sonepur are excluded, but particulars regarding vaccination in the State of Bastar have been included for the first time. The supervising staff, besides the Sanitary Commissioner, consisted of 19 Civil Surgeons and 28 Native Superintendents, and the average number of vaccinators employed was 260, including 51 in the feudatory states. The total number of operations performed was 397,036—a decrease of 52,684 as compared with the previous year. The falling off was common to British territory and to the feudatory states; and to primary operations decrease 30,762, and to re-vaccinations, decrease 21,922. Many causes contributed to hamper the work of vaccination in the province: (*a*) a diminished birth-rate consequent on the scarcity from which the northern districts have suffered for the past three years; (*b*) the establishment of famine conditions in 14 out of the 18 districts during the cold months, November to March, when the most of the work is done; (*c*) the vagrancy induced by the pressure of distress; and (*d*) the withdrawal of vaccinators from their ordinary work for duty in connection with famine and plague. The provincial establishment vaccinated 294,101 persons primarily, and 96 per cent. of the operations are said to have succeeded; they re-vaccinated 33,356, and of these operations 71·7 per cent. succeeded. In the feudatory states 97·2 per cent. of 57,051 vaccinations and 96·0 per cent. of 10,452 re-vaccinations are stated to have been successful. In spite of high ratios claimed in the native states, raising the general average percentage of success in primary operations to 96·2 and in re-vaccinations to 77·68, the figures are lower than in 1895-6, when 96·37 of the primary operations and 82·11 of the re-vaccinations succeeded. The average numbers of operations performed per vaccinator were, in British territory, 1,557 and in the feudatory states 1,564, decreases, respectively, of 208 and 267.

By the dispensary staffs, 15,027 primary operations and 1,746 re-vaccinations were performed, and 90·99 and 72·39 per cent., respectively, succeeded. The percentage of the estimated number of children born who were protected during the year was 47·5, against 49·3 in 1895-6, and 52·9, the mean of the previous three years.

Inspections suffered in the same way as operations from the interference of more urgent work. Civil Surgeons inspected 15·78 per cent. of the total number of operations and native Superintendents 50·24 per cent., against 18·5 and 51·13, respectively, in 1895-6. The percentage of success verified by the former was 92·01, and by the latter 93·46.

During the year, the Inspector General of Education issued a circular letter to the Inspectors of Schools urging them to enforce "with great strictness" the provisions of Articles 101 (*c*) and 268 of the Educational Code, and to ascertain whether scholars have been protected or not on the occasions of examinations in gymnastics, etc., and when passing them for grants.

The bulk of the vaccinations was carried on by means of animal lymph against the use of which there is said to be no prejudice worth noticing. Altogether 9,844 calves were operated on; of these, in 711 the vaccination failed to take, and 209 had to be rejected on account of excessive inflammation or suppuration of vesicles—a total failure of nearly one in ten. From the lymph obtained from the remainder, 240,217 children were vaccinated, and 94 per cent. of the operations succeeded.

The strength of the Department in Berar remained unchanged and consisted of the Sanitary Commissioner, seven Native Supervisors and 44 vaccinators. The total number of operations performed was 120,111, a number only twice exceeded in the last twelve years. The number of operations performed by each vaccinator rose from 2,423 in 1895–96, to 2,729 in the year under report. The number of primary operations was 98,594 and of re-vaccinations 21,717, and success was obtained in 96·8 and 20·5 per cent. of the cases respectively, as compared with 95·9 and 23·4 in the previous year. The percentage protected of the estimated number of infants born was 66·8, against 58·2 in 1895-96, and 60·9, the mean of the preceding three years.

Inspections were made at the rate of 1·6 per cent. by the Sanitary Commissioner and 55·8 per cent. by native Superintendents, the ratios of success verified being 97·0 and 95·2 per cent., as compared with 96·8 per cent. reported by the vaccinators. Dr. Little

explains that he finds a higher ratio of success than the Superintendents, because most of the cases which the latter discovered to be unsuccessful have been re-vaccinated before he sees them, and suggests, as an explanation of the ratios of success discovered by Inspectors being higher than that claimed by operators—a phenomenon observable in the returns of the Basim district of Berar, and in other provinces besides Berar,—that the vaccinators calculated on the total number of operations counting unknown cases as failures, whereas the results of all cases seen by the inspecting officers are, of course, known ; the excluded percentage of success among unknown cases accounting for the difference. The Compulsory Vaccination Act was introduced into the town of Karinja during the year and is now in force in all the municipalities.

The use of animal lymph is now universal throughout Berar, to the entire exclusion of the arm-to-arm method. Dr. Little gives an account of the methods adopted by him, quoted, not only because of the interest of the passage, but because of the success which has attended the work in Berar.

" Since I first entered upon the duties of the Sanitary Commissioner's office in October 1878, animal " lymph obtained from the cow has been more or less used in the province. It was first tried for " the purpose of renewing our supply and starting the season's operations, and we were thus able to " dispense with the annual supplies of English lymph furnished by Government, for this purpose. " The procedure in this respect followed in Berar was brought to the notice of other Governments and " Administrations—*vide* paragraph 4 of Home Department No. 68, dated 8th March 1882.

" After a time, when Superintendents and Vaccinators became more skilled and experienced in " animal vaccination, the work of the province came to be carried on partly with animal and partly " with humanized lymph until 1890, when a scare was raised as to the possibility of transmitting " leprosy through the medium of humanized lymph. Arm-to-arm vaccination was then completely " abandoned, and the work carried on entirely with lymph propagated from the cow or buffalo. The " people of the province were by this time quite accustomed to the idea of cow vaccination, which " had been thus gradually and quietly introduced, and there was no difficulty experienced in " substituting animal for humanized lymph ; indeed, native feeling has come to prefer the animal " lymph, for they were quick to perceive that their children suffered less when cow lymph was used ; " that it either took or failed without subsequent ulceration, whereas the arm-to arm method in the " hands of a careless vaccinator not infrequently resulted in severe ulceration and inflammation of the " child's arm. Over and over again have the villagers told me this, and personally I seldom or ever " see now the ulcerated and inflamed arms which were but too common under the old arm-to-arm " system as practised by uneducated and unprofessional men at a distance from immediate " supervision.

" Another point in favour of animal lymph, in public estimation, was that calf vaccination did " away with the necessity for a child being taken from one village to another for the purpose of " affording a lymph supply, or for the child of a high caste man being vaccinated from one of low " caste, both procedures being unpopular and often strongly objected to.

" In regard to religious prejudice, none was met with, though it is more than probable that had the " villagers not been gradually accustomed to see calves and buffaloes vaccinated, until it had become " quite a commonplace procedure, and had they not had time to realize the advantages to themselves " accruing from the use of animal lymph, I have no doubt objection would have been raised on one " ground or another.

" When the system of vaccination direct from the calf to the exclusion of the arm-to-arm method " was introduced, it was anticipated there would be some trouble in the procuring and feeding of the " calves ; but this has not proved to be the case, save in municipalities, where, owing to the difficulty " of procuring animals, the use of lanoline lymph has been recommended.

" Berar being entirely an agricultural province with large herds of cattle in most villages, there is " no difficulty, as a rule, in obtaining calves for vaccinating purposes. The village patel supplies the " vaccinator, on loan, with the animals required, receiving a receipt for the same, he, in his turn, " passing a receipt to the vaccinator when the calf is returned to him. Each vaccinator has a circle " assigned to him, averaging some 60,000 inhabitants, and is required to reside permanently in his " circle. This circle is sub-divided for vaccination purposes into small circles, each of which has to " be taken up systematically in rotation and protected, as far as possible, at the rate of 40 per 1,000 of " the population. Before leaving one sub-division and going on to another, the vaccinator has to " report to his Superintendent and obtain his permission, which is not granted if the Superintendent " considers the rate of protection afforded insufficient. Under this arrangement District Superin- " tendents have systematic control over their men, and the vaccinator, or "*Devi Doctor*," as he is " called, comes to be well known to the people amongst whom he resides, and, if he is a good man, " soon gains their confidence and respect.

" At the close of the monsoon, generally about the end of September, each vaccinator is furnished " with a small quantity of lanoline paste lymph to start his supply, which is allowed to die out during " the rains. With the paste a few children are vaccinated, and when a successful result has been " obtained, a calf is inoculated from a child's arm, and vaccination then kept up from calf to calf or " renewed from a healthy child should it show signs of degenerating. The method of itineration is " as follows. On the result day, in a certain village, the vaccinator protects, as far as possible, all the " available children, and operates upon one or more calves ; these he distributes to the village or " villages he may have arranged to work in next, usually situated not more than three or four miles " distant, leaving the animal in charge of the patel, who tells off a *watandar dher** to look after it, " and to supply it with grass and water. Only weaned animals are used for vaccination purposes. " The vaccinator having fixed a bamboo collar to its neck to prevent it licking itself, goes off to

* Hereditary village Servant.

"another village, where he may have a result to record, or another calf ready to yield lymph for "vaccination. On the fifth day, or 96 hours as near as possible from date of operation, he returns to "inspect the calf, and if the result is successful, which is usually the case, he has the children "collected and proceeds to vaccinate them, first cleansing the shaven part of the calf with warm water "as well as the children's arms—at least he should do so—though this part of the procedure is, I am "afraid, often neglected. Sometimes, when villages are close together, a calf can be taken from one "to the other on the result day; but if taken any distance, the vesicles get rubbed.

"In this way, some vaccinators in the height of the working season have a calf result every "day of the week, or at least one every other day, which can generally be managed by little "arrangement.

"It will thus be seen that nothing is paid by the department for either the hire or feed of the "calves, and no difficulty up to now has, as a rule, been experienced in procuring any number of "animals save in municipalities, where the work will in future be carried on with lanoline paste "lymph."

The supervising staff in Madras Presidency was made up of one Deputy Sanitary Commissioner and 59 Deputy Inspectors, and Civil Surgeons carried on inspections in their districts. The average number of vaccinators was 834. Although the number of operators was eight less than in the previous year, the number of operations performed rose from 1,178,970 in 1895–96 to 1,234,350 in 1896–97, and the number of vaccinations performed by each man from 1,383 to 1,465. Of the total number of operations, 1,161,127 were primary and 73,223 were re-vaccinations, the percentages of success reported being 92·6 and 80·2, respectively, as compared with 87 and 80·5 in the preceding year. In consequence of its having been made optional for the medical officers attached to dispensaries to carry on vaccination, there has been a progressive decline of late years in the numbers vaccinated by the dispensary staffs. The number vaccinated by them in 1894–95 was 26,410; in 1895–96 the number fell to 19,201; and in the year under report there was a further fall to 13,370. Of these 12,004 were primary vaccinations, successful at the rate of 88 per cent.,—a ratio, in the opinion of the Deputy Sanitary Commissioner, approximating to the degree of success generally attainable in the presidency; and 1,366 were re-vaccinations, of which 74·8 per cent. were successful.

The percentage of the estimated number of children protected was 23·2 against 22·0 in the previous year, and 18·6, the mean of the previous three years.

Of the total number of vaccinations performed, 2·5 per cent. were verified by Civil Surgeons and 49·8 per cent. by native Superintendents and others. The ratios of success found by these officers were practically the same as last year,—90·8 and 89·5 per cent., respectively, as compared with 92·0 per cent. reported by vaccinators.

Except in 226 cases vaccinated in Ganjam, with humanized lymph, the vaccine used was derived from the calf and was applied (*a*) direct, (*b*) in tubes without admixture, (*c*) in tubes with glycerine added, and (*d*) in tubes with lanoline added. In the following table the results obtained with the various vaccines are given :—

	Number of cases.	Percentage of success.
(*a*) Lymph taken direct from arm to arm	287,225	97·2
(*b*) Lymph in tubes or plates	118,695	94·6
(*c*) Lymph in tubes with glycerine	649,700	88·9
(*d*) Lymph in tubes with lanoline	68,471	94·0

The lymph sent out in tubes and plates without admixture was invariably used at once, which accounts for the high ratio of success attained with it.

The vaccination staff under the Civil Surgeon of Coorg consisted of one Native Inspector and eight vaccinators. There was a slight falling off in the number of operations as compared with the previous year : 10,006 having been performed against 10,411, and the number of persons vaccinated by each operator fell from 1,157 to 1,112. Of the total, 8,717 were primary operations, and 1,289 were re-vaccinations; the percentages of success attained were 96·81 and 89·76, respectively, as compared with 95·72 and 86·27 in 1895–96. Besides these, 505 operations were performed by the dispensary staff; 52·07 of 363 primary operations and 21·13 per cent. of re-vaccinations were successful. The percentage protected of the estimated number of children born was 18·6, against 17·2 in 1895–96, and 13·3, the mean of the previous three years. Vaccinations were performed with calf lymph. The cost of the establishment rose from Rs. 2,600 in 1895–96 to Rs. 2,790 in 1896–97, and the cost of each successful case from four annas and one pie, to four annas and eight pies.

In Bombay Presidency the supervising staff consisted of five Deputy Sanitary Commissioners, and 45 Inspectors of Sanitation and Vaccination and the average

number of vaccinators was 437, inclusive of 78 employed in native state territory. Besides these there were employed 16 clerks and 512 peons. The total number of operations was 802,738, against 803,850 in 1895–96, and the average number performed by each operator was 1,834, or 20 less than in the previous year. The decrease is attributed to the outbreak of plague in Bombay and to the occurrence of floods in Sind. Of the total number of operations 732,893 were primary, of which 92·19 per cent. succeeded, against 93·25 in 1895–96; and 69,845 were re-vaccinations, of which 59·64 per cent. were successful, as compared with 57·59 per cent. in the previous year. Besides these, 1,344 primary operations, of which 85·67 per cent. succeeded, and 905 re-vaccinations with success in 76·13 per cent., were performed by the establishments of dispensaries. Of the estimated number of children born, 59·1 per cent. were protected, as compared with 58·0 per cent. in the previous year, and 56·2 per cent., the mean of the preceding three years. The percentages of cases verified by Deputy Sanitary Commissioners and Native Inspectors were smaller than in the previous year,—4·74 and 36·42 as compared with 7·03 and 37·67, and the proportions of cases found by them to be successful were also less, 80·9 and 97·1 per cent., against 95·55 and 99·01.

Bovine lymph was exclusively used throughout the year in the city of Bombay; and elsewhere it was used in selected areas.

In the native states of Baroda, Cutch, Kathiawar, Palanpur and Idar, 212,474 primary operations and 8,320 re-vaccinations were performed with success, respectively, at the rates of 94·13 and 69·5 per cent. The number of infants protected in these states fell from 162,069 in 1895–96, to 161,514.

In Lower Burma the vaccination staff consisted of 10 Native Superintendents and 110 vaccinators. The number of operations rose from 242,845 in 1895-96 to 288,381, and the average number performed by each man from 1,974 to 2,622. The increase in the work was distributed throughout the province, except in the Arakan Hill Tracts, the district of Akyab, and the town of Rangoon. The falling off is attributed, in the Hill Tracts to the inefficiency of the vaccinator; in the Akyab District, to inefficient supervision; and in Rangoon town, to an unfortunate occurrence which led to the prohibition by the President of the Municipality of the compulsory vaccination of coolie immigrants who have furnished by far the largest proportion of cases in past years. The President's order resulted from the death from tetanus after vaccination of a gardener in the employment of the German Club. The attack of tetanus from which the gardener died does not appear to have been due to the vaccination, but to his having applied a paste of leaves and earth to the vesicles. The orders issued, however, produced such a feeling of alarm in the popular mind that no adult coolies could be induced to submit to vaccination.

Of 267,146 primary operations, and 21,235 re-vaccinations, 92·01 and 58·79 per cent., respectively, succeeded, against 91·21 and 46·01 in the previous year. The establishments attached to dispensaries performed 1,735 primary operations, and 276 re-vaccinations, of which 94·58 and 44·63 per cent. succeeded. The relatively large number of re-vaccinations was due to the performance of 2,146 in the district of Hanthawaddy, where there was a great deal of small-pox.

The ratio of infants protected was 34·3 per cent. of the estimated number of births, as compared with 22·0 per cent. in 1895–96, and 14·2, the mean of the previous three years. The percentages of the total number of operations verified by Civil Surgeons and Native Superintendents were somewhat higher than in the previous year—15·93 and 24·6 respectively, against 14·61 and 18·13.

In Upper Burma, the staff consisted of the Civil Surgeons, one Native Superintendent and 51 vaccinators. The number of operations performed was 126,464—a satisfactory increase as compared with 1895–96, when the figure was 115,703. The average number performed by each vaccinator rose from 2,143 to 2,480. Of 123,520 primary operations and 2,944 re-vaccinations, 93·34 and 64·64 per cent., respectively, were successful, as compared with percentages of 92·67 and 66·65 in the previous year. The staffs of dispensaries were successful in 89·06 per cent. of 3,731 primary operations and in 65·22 per cent. of 161 re-vaccinations. There were 41,295 infants protected during the year as compared with 30,741 in the previous year. The percentage of operations inspected by Civil Surgeons was 33·58, and by the Native Superintendent, 10·18.

Vaccination in the Shan States continues in a very backward condition; only 4,401 operations were performed by vaccinators and 158 by the dispensary staff—all primary. The instruction of the *sayas*, or native doctors, was discontinued in the Southern States towards the end of 1896, as it was found impossible to check their work, and a proposal to instruct the same class in the Northern States was rejected, because, as a rule, the *sayas*

are lazy and untrustworthy. The entertainment of additional travelling vaccinators in the Southern States has been sanctioned, and an improvement in the results obtained may be anticipated.

Lymph paste was obtained from Bangalore and was manufactured locally;—the pastes made in Rangoon and in Taunggyi being very satisfactory.

The staff in Ajmere-Merwara consisted of two Superintendents and 13 vaccinators—one more vaccinator than in 1895–96. The total number of operations rose from 15,978 in the preceding year, to 16,282, but the average number of operations performed by each vaccinator fell from 1,331 to 1,252. Of the total, 15,962 were primary operations and 320 were re-vaccinations, successful at the rates of 96·82 and 75·62 per cent., respectively. The ratio of infants protected was 51·3 per cent. of the estimated births, as compared with 46·3 per cent. in the previous year and an average of 40·5 per cent. in the preceding three years.

Civil Sanitary Works.

During the year under review, sanitary improvements in very many, if not in the majority, of the towns had to be postponed or curtailed on account of impending scarcity. As some compensation for this, there may be reckoned the excavation in many districts by relief workers of numerous tanks and wells, most of which will prove of permanent advantage to the people.

While it is satisfactory to note that improvement, especially in the direction of water-supply schemes, is on the whole steady, it seems to be doubtful if the very best results possible from the money expended are always obtained. An examination of the mortuary statistics of towns before and after the introduction of new water-supplies shews that the death-rates are not always reduced in the degree that might be expected; and that, in some towns, the mortality has been *apparently* greater after the introduction of the new supply than it had been before. The increased death-rates can be easily shewn in most cases to be due to improved registration, an improvement naturally coincident with the greater interest given to sanitary affairs. But when the good results that might be looked for do not follow the introduction of a new supply, it is not sufficient to give the comforting explanation that improvement has taken place in the registration of deaths; this may be the case, but very careful enquiry into all possible causes of increased mortality should be undertaken. There may be no real improvement in the quality of water consumed, or some condition detrimental to the public health may have accompanied the introduction of an improved supply of water. In most of the towns, it may be concluded from the amount of water per head that is taken from the works, that a mixed supply is being used; and this is an unmixed evil, for the old sources of water are much less likely to be conserved than they were before the introduction of new supplies. It may be that sufficient care is not bestowed upon the works, and that the water when it reaches the public has been improperly filtered. A municipality may spend lakhs of rupees on a catchment area and in providing reservoirs, filter-beds, mains and stand-posts, but give no attention to the upkeep of the works. Water-supply works require expert management, and to entrust their control to a man who knows nothing of hydraulics and less about the delicate working of a filter-bed is to court disaster, however skilfully and economically the pumping engines may be managed. Again, drainage may be at fault, where a greatly increased quantity of water is brought into a town before adequate means to remove it have been provided.

The most hopeful sanitary advance during the year, then, is the reconstitution of the Sanitary Boards in Bengal and in the North-Western Provinces. A properly constituted Sanitary Board, endowed with sufficient control over municipal bodies, will ensure continuity of work undertaken, and so prevent the introduction of schemes to bring water into towns before sufficient means for its removal exists; and they will not permit municipal councils to allow works in which large capitals have been sunk to prove useless, or even dangerous, from want of efficient supervision.

As explained in the Report for 1895, the figures relating to expenditure on sanitary works in Bengal have reference not to the calendar year but to the official year ending with the 31st of March. This change was made in 1895, in order that comparison with similar figures, furnished in reports on municipal administration, might be more easy.

Omitting Calcutta, the number of municipalities in Bengal in 1895–96, was 145, or one less than in the previous year, but the total income, including the opening balances in

both cases, rose from Rs. 45,53,651 in 1894–95, to Rs. 46,02,679 in the year under review. Of this total, 52·79 per cent. was spent on original and recurring sanitary works, 9·03 per cent. on roads, 4·52 per cent. on the public safety, and 23·40 per cent. on other requirements. Under the three principal heads of expenditure, the totals were Rs. 9,96,441 on water-supply, Rs. 8,88,026 on conservancy, and Rs. 1,49,559 on drainage. As compared with 1894–95, there was a substantial increase of R1,98,832 devoted to water-supply, and a slight increase in the cost of conservancy, while the large decrease of Rs. 1,24,182 in the expenditure on drainage was due to inclusion in the total of the former year of Rs. 1,08,768 on account of the Patna drainage scheme, on which, in 1895–96 only Rs. 4,874 were spent.

The average proportion of income spent on original works was 5·03 per cent. In seventeen municipalities, including Jalpaiguri (34·84), Tittagarh (29·36), and Cossipore-Chitpur (19·06), where the highest proportions were expended, more than 10 per cent. of the municipal income was thus disposed of, while in 28, nothing at all was so spent. The average expenditure on recurring sanitary works was 37·64 per cent., ranging from 61·81 in English Bazar, in Malda, to 4·56 in Joynagar.

The most important sanitary business of the year were the completion of the Howrah water-supply works, which were opened in February 1896 by Sir Alexander Mackenzie; the completion of the Muzaffarpur drainage scheme; the extension of the Cossipore Chitpur water-supply; additions of the Serampore and Jalpaiguri drainage works; and the improvement of the water-supply, and the construction of drains, at Bhagalpur.

Nightsoil is trenched in most places on improved principles; but the cultivation of the trenching grounds does not seem to receive the attention from the municipal authorities which its importance demands. Dr. Dyson suggests that municipalities should be required to cultivate these grounds and exhibit the crops on market days in order to shew the superiority of the produce of the highly manured land. He suggests also that the municipal cultivator, should, in addition to his pay, get a percentage on the sale of the produce.

While the expenditure on sanitary works in rural areas amounted to Rs. 1,42,012 against Rs. 1,03,912 in the previous year, but little advance has, it is stated, been made in rural sanitation. Owing, however, to the deficient rain-fall and the consequently impending scarcity, numerous tanks and wells were dug, many of which will, no doubt, prove of lasting benefit to the localities in which they have been made. The sum provided by private generosity for sanitation, which in 1894–95 amounted to Rs. 1,88,875, rose to Rs. 4,94,131.

During the year the Sanitary Board was strengthened by the addition to its membership of the Chief Engineer to Government in the Public Works Department, and was composed as follows:—

The Member of the Board of Revenue in charge of miscellaneous revenue ...	*President.*
The Chief Engineer to Government in the Public Works Department	*Members.*
The Chief Engineer to Government in the Irrigation Department	
The Sanitary Commissioner	

with the Sanitary Engineer as Secretary. Not only was the Board strengthened but its functions were enlarged, and it has been ordered that all schemes relating to sanitary works should be referred to the Board for approval. The importance of such an enhancement of the scope of the work of the Board cannot be over-rated, and calls for imitation in other provinces, especially in those in which no Sanitary Engineer has as yet been specially appointed.

There was the usual difficulty in holding meetings of the Board owing to the absence of members from head-quarters, and business had to be carried on by circulation of papers.

The principal projects with which the members dealt were the following:—

(1) A scheme estimated to cost Rs. 33,232, for improving the drainage of Krishnagar by the excavation of the Anjuna Khal.

(2) The Berhampore water-supply scheme, estimated to cost Rs. 2,38,883, was finally passed. This work, which is the gift of the late Maharani Surnamoyee, C.I., will, it is expected, be completed in 1897.

(3) A scheme for the supply of filtered water to the municipalities situated on the left bank of the Hooghly. The Board were obliged to recommend the abandonment of this project as the cost, owing to the provision of elevated reservoirs to ensure a constant supply and the scattered situation of the populations, was prohibitive.

(4) Schemes for draining the suburbs of Calcutta and remodelling the storm-water outfall, to cost Rs. 78,87,089, which were drawn up by Mr. A. H. Hughes, C.I.E., Engineer to the Corporation, were examined and approved.

(5) An alternative scheme, to cost Rs. 2,50,000, for the supply of drinking-water to Midnapore.

(6) An estimate for developing the existing distribution of water from the Howrah water-works.

(7) Estimates and plans for the supply of pure water to the town of Chittagong. The estimated cost of the scheme is Rs. 2,37,898, but the matter has been referred to the local officers for reconstruction of the scheme on lines indicated by the Sanitary Engineer to the Board.

(8) A scheme for the supply of pure water to Cuttack, at an estimated cost of Rs. 2,25,000; this had to be abandoned as beyond the means of the municipality.

The Board also gave opinions regarding a large number of miscellaneous subjects which were referred to them, and the Sanitary Engineer made many useful enquiries and inspections.

The total income in 1896 of the municipalities, towns, unions and stations in Assam, excluding the towns of Hailakandi, Sunamganj, Karimganj and Maulvi Bazar, which have no separate incomes of their own, amounted to Rs. 2,62,416. Of this sum Rs. 1,38,592, or 46·10 per cent., was spent on sanitary works, as compared with Rs. 1,15,175, or 44·13 per cent., of the total income thus expended in 1895. The highest percentage of municipal income devoted to sanitation was 71·37, spent in the small town of Mangaldai, the lowest 24·21, in the union of Jorhat.

As has frequently been noted, the towns of Assam are really populous straggling villages, built generally on level sites, so that any extensive schemes of water-supply or drainage must necessarily be expensive and beyond the means of comparatively poor communities.

In Gauhati and Shillong there are waterworks whence piped supplies of water are distributed in the municipal areas. A new pumping-engine was ordered for the works in Gauhati, but did not arrive, and during 1896, the old engine frequently broke down, owing, seemingly, to defects in the boiler, so that water was frequently not available from the works. In Shillong, some extension of the pipe-supply was made, and it is proposed to extend the station supply to the cantonment.

In the report for 1893, an account of the projected water-supply works at Sylhet was given. It was intended to sink wells on a suitable site, and to pump water from them to an elevated reservoir whence, after proper filtration, it would be distributed by pipes and hydrants. It appears, however, that this scheme was unsuitable, and the following remarks regarding it are taken from the Resolution, published by order of the Chief Commissioner which accompanies the report of the Sanitary Commissioner :—

"The first of these wells has recently been completed at a cost of Rs. 7,700, the work of "construction having lasted for several years. Mr. Cotton's attention was drawn to the matter while "on tour in Sylhet, and he ascertained that the scheme, if completed, would involve a capital "expenditure of nearly two lakhs of rupees, to say nothing of the cost of maintenance. A town of "the size of Sylhet, containing only 15,000 inhabitants, is too poor to be able to construct or maintain "water-works on such a scale, and the Chief Commissioner has, therefore suspended further "operations in connection with the scheme while pointing out other means for improving the water-"supply of the town at a cost within the means of the inhabitants."

In many towns, wells have been constructed, but the inhabitants decline to drink water from them, preferring water from rivers and tanks. It is generally impossible to prevent the pollution of rivers, and the Sanitary Commissioner seems to be of opinion that the best method of improving the water-supply is to protect the tanks and make arrangements to pump the water from them into reservoirs, from which it can be drawn off by means of taps.

Silchar, Manipur and Fort Aijal are the only places where excreta are destroyed by fire —this, it appears, can be successfully done by means of Young's incinerator. In other towns, the trenching system is in force, and is stated to be satisfactory only when carefully carried out in places where the trenches are not liable to be flooded during the rainy season. In rural areas, no sanitary work of any magnitude was begun, but a large number of masonry wells were sunk, old wells were cleaned, and tanks were repaired. It has for some time past been the policy in Assam to discourage the excavation of tanks and insist on the construction of masonry wells for the provision of drinking water. But, as already stated, the people greatly prefer tanks to wells, and, as it is impossible to exercise proper supervision over either tanks or wells in rural areas, the

Chief Commissioner, after considering all the arguments for and against tanks as a source of water-supply, has decided to remove the absolute prohibition against the digging of tanks, leaving it to the discretion of Local Boards to carry out the measures in their opinion best suited to the locality concerned.

"The Sanitary Board did not meet during the year."

The income of the 103 municipal towns in the North-Western Provinces and Oudh, in 1895–96, excluding opening balances, was Rs. 52,92,870, as compared with Rs. 55,06,002 in the previous year. Although the income was slightly less than in 1894–95, the expenditure on sanitary works, except for conservancy, markets, etc., was greater; on water-supply Rs. 10,97,305, against Rs. 8,29,523; on conservancy, Rs. 8,88,488, against Rs. 8,97,945; on drainage, Rs. 4,30,079, against Rs. 3,42,500; and on markets and slaughter-houses Rs. 47,723, against Rs. 56,432.

There are several large municipal towns in the provinces, namely, Agra, Allahabad, Benares, Cawnpore, Lucknow, Meerut and Bareilly, and all, except Bareilly, have now been furnished with complete water-supply works, varying in cost from Rs. 25,62,000 at Benares, to Rs. 7,40,000 at Meerut, all met from loans advanced by Government, to be repaid with interest by sixty half-yearly instalments. In each of these towns, an Engineer has been employed to carry out and maintain the works, and to give effect to any extensions which may be necessary. The Meerut Board have dispensed with the services of their Engineer from 1st April, and placed the control of the water-works in charge of the Superintendent, an experiment which the Sanitary Engineer of the province notes, "will "be watched with every care, and some amount of interest."

Two hill stations of Mussoorie and Naini Tal have also pumped water-supplies, and the works have been supervised by the Municipal Secretaries who, as a rule, have also been engineers, "but the results seem to indicate that some better and more efficient professional "control is required." It is in contemplation to appoint a Superintendent of Machinery for the provinces; the need for having such an officer to supervise the working of the different pumping engines has been apparent during the year, but the demands of famine works have necessitated too rigid economy in every direction to admit of an appointment being made.

The Meerut water-works were opened early in 1896, and the supply was available for general use from the 6th of May. The original estimate of Rs. 8,00,000 was reduced to Rs. 7,50,000, and the actual expenditure will probably be less. During 227 days the supply amounted to 73,238,631 gallons, equal to 4·55 gallons per head per diem. The character of the supply is good, although, owing to one filter being carelessly worked, 3,000 microbes in a c.c. were on one occasion present. The average of a large number of samples from that filter, however, was only 25·8 microbes in the c.c., and in samples from other filters even less. Only one house connection was made.

The Dehra-Rajpur works were completed in the beginning of the hot weather. This is a gravitation supply from the springs half way up to Mussoorie. The estimated cost was Rs. 97,241, but, owing to a favourable rate of exchange, the actual cost was only Rs. 93,100.

At Benares, 628,846,304 gallons were supplied, equal to 8·12 gallons per head, against 7·5 gallons in 1895. The number of house-connections is 3,887. The character of the supply was good. A raised reservoir, estimated to cost Rs. 78,036, was commenced just before the rains, and is rapidly approaching completion. The reservoir wil hold 250,000 gallons, and will give an initial head of pressure between 71 and 56 feet.

At Lucknow, 391,309,106 gallons were supplied, equal to 2·95 gallons per head, a slightly increased consumption as compared with 1895, when it was 2·6 per head. There are practically no house-connections. The supply was generally good. A raised reservoir to hold 250,000 gallons, and giving a head at the filtering station, where it has been erected, of from 53 to 42 feet, was finished at a cost of Rs. 60,255. Several extensions of the water-supply, notably to the Chauk and Daulatganj wards, were made.

At Cawnpore, 391,309,196 gallons were delivered, equal to 7·5 gallons per head, considerably less than in 1895, when the average consumption was 8·41 gallons. The number of house-connections was 93, and about 35 miles of drains were flushed daily. The quality of the water was good.

At Allahabad, 580,024,042 gallons were supplied, or 10 gallons a head, against 8 in the previous year. There were 1,430 house-connections, and over 16 miles of drains were flushed daily. The supply was generally good, although on two occasions it was reported that a microbe believed to be that of enteric fever was detected in the filters. An investigation was made in both instances, and the result reported to Government.

The extension of the water-supply to Daraganj and the site of the fairs, was under construction.

At Agra, 569,406,613 gallons of water were supplied, or 10·5 gallons per head per diem, against 8 in the previous year. Thirty-four house-connections were made, bringing the total to 597. The water was of good quality.

At Naini Tal the amount of water delivered could not be exactly estimated, but it is stated to have been quite inadequate to the requirements, and the pumping arrangements were faulty. A new scheme has been adopted.

At Mussoorie, 6·4 gallons per head were supplied daily. There was no house-connections and the drains are not flushed.

The cost of delivering 1,000 gallons of filtered water in 1896–97 was rather more than $1\frac{1}{2}$ annas in Agra. Allahabad and Benares; just over 2 annas in Cawnpore and Lucknow; $2\frac{3}{4}$ annas at Meerut, where the cost is expected to fall; the cost at Mussoorie is not known, and at Naini Tal it was just under a rupee.

A preliminary rough estimate, amounting to Rs. 7,00,000, for works at Bareilly was considerably beyond the resources of the municipality. Water-supply projects for Farukhabad-Fatehgarh, Fyzabad-Ajudhia and Jhansi are in contemplation.

The sewerage and drainage scheme at Benares is by far the largest and most expensive which has been undertaken in the province. The total cost is estimated at Rs. 19,40,000, and work to the value of Rs. 6,00,327 has been completed. The main sewer, outfall, and subsidiary works were expected to be completed early in 1897, and branch sewers in the unsewered area later in the year. Owing to financial pressure, part of the work has been postponed, and, in the meantime, a programme of the work to be taken up year by year has been drawn up.

At Cawnpore, the greater portion of the scheme for the *Sadar Bazar* was completed, but there was practically no progress made with the main project for the city.

At Agra, the paving and draining of *Muhallas* is being continued. Estimates and plans for an intercepting sewer, to run along the river bank, and so cut off the eight main drains which at present run right into the river, were prepared and are being considered.

At Mussoorie, a scheme estimated to cost Rs. 40,000, for a sewage shoot and farm is being carried out. So far only Rs. 19,449, for land and pipes, which are now at the site, have been spent, as, owing to defective preliminary arrangements, the work was not begun.

At Kasganj, in the Etah district, a scheme for improvement of the drainage was completed.

At Hardwar, a four-celled incinerator on the Garlick type was completed, but the working of it, probably on account of lax supervision, has not been satisfactory. It was reported that in 84 days 1,334 maunds of nightsoil were consumed, with an expenditure of 2,200 maunds of fuel, to which 2,388 maunds of street sweepings were added, the cost being about $4\frac{1}{2}$ annas per maund of filth, which is excessive. It is hoped that care in the use of fuel and a better way of treating the nightsoil before it is burned, may prove more economical.

Drainage schemes for Bareilly, Fyzabad-Ajudhia, Farukhabad, Jhansi, Pilibhit, Dehra, Hathras, Saharanpore, Muzaffarnagar, Aligarh, Deoband and Hardwar have been proposed or are in contemplation.

Many improvements were carried out in rural areas, and although the circumstances of the year were not favourable to the execution schemes of sanitary improvements through the ordinary staff who were otherwise fully occupied, the relief-works undertaken in the neighbourhood of many villages will prove of permanent benefit.

During the year the Sanitary Board was reconstituted, and converted from a consultative into an executive body; funds were placed at its disposal, and definite functions delegated to it. The resolution* by the Local Government in which these changes are ordered deals with the reorganization of the sanitary service of the province generally, and from the sanitary point of view is one of the most important ever issued by a Local Government in India.

There were three meetings of the Sanitary Board during the year, two at Naini Tal under the old organization, and one at Lucknow, of the reconstituted Board. The following were among the subjects considered at the first two meetings:—

(1) The report of the Provincial Sanitary Commissioner for 1895; attention was specially drawn to remarks on defective registration.

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* See Appendix A, p. 141.

(2) The final draft of a letter to the Local Government, containing the Board's opinion on the best method of maintaining village sanitary records, was approved.

(3) The attention of the Board was called to delay in extending the water-supply of Allahabad to Daraganj, and the delay brought by them to the notice of Government, with the best results.

(4) The abnormally heavy mortality in the small town of Baghpat and Deoband. The Board deputed the Sanitary Commissioner and the Sanitary Engineer to make enquiries on the spot.

The new Board met at Lucknow on the 23rd November 1896.

1. It was arranged to obtain from Commissioners, lists of sanitary works contemplated in the various divisions.
2. It was decided to ask Government for an increase of strength, and reorganization of the pay, of registration clerks in each district.
3. The Sanitary Commissioner's instructions to Civil Surgeons regarding the regrouping of registration circles were approved.
4. It was decided to ask Government what funds would be placed at the Board's disposal during the coming year.
5. A proposal of the Chemical Examiner to discontinue the chemical analyses of municipal water-supplies in favour of bacteriological analyses alone was negatived, as the former were considered quite as valuable as the latter for the purposes for which the examinations are made.

The income of the municipal towns in the Punjab in 1896, including an opening credit balance of Rs. 12,28,318, was Rs. 53,98,100, against Rs. 55,30,673 in the previous year. Of the total, Rs. 12,36,690 was devoted to sanitary works, against Rs. 12,33,037 in 1895. Under the three main headings, water-supply, drainage, and conservancy, sums, respectively, of Rs. 1,66,744, Rs. 1,26,608, and Rs. 5,83,174 were expended.

The amount realised from the sale of manure and town sweepings was Rs. 1,36,076, which, although upwards of Rs. 3,000 less than in 1895, was a larger sum than those obtained in previous years.

During the year the Haripur water-supply scheme was completed at a cost of Rs. 43,000. The piped water-supply of Kohat was extended to the small village of Chillarkot close to the cantonments. The project for the water-supply of Bhiwani, in the Hissar district, was begun. Some progress was made with the Ludhiana scheme, while that for the supply of Ferozepore cantonment was considered.

In Delhi, a portion of the drainage scheme was completed, and estimates for the remainder were sanctioned. Drainage projects for Lahore, Mooltan, Gujranwala, Rawalpindi and Hazro were in process of being carried out ; estimates for schemes for Ladwa, Umballa, Ferozepore and Fazilka were under consideration ; and similar estimates for Gurdaspur, Gujrat and Jagraon were prepared.

In the Delhi district, the construction of a filth trenching farm was begun. The area is about 250 acres situated south of the city of Delhi. This area is divided into three plots, one of which will be trenched, while a second is lying fallow and the third cultivated.

The Sanitary Board met twice during the year, and considered the following subjects :—

1. Correspondence in connection with the Ferozepore City and Cantonment Drainage Scheme, with a note by the Secretary to the Board, shewing what further progress had been made in the matter since July 1894.
2. Statements, drawn up by Mr. E. Oliver, when officiating as Chief Engineer, in which he described the sanitary condition of the municipal towns, and suggested improvements. Copies of these statements were sent to the local officers concerned with enquiries as to how far they were in a position to carry out the suggested improvements.
3. The progress report of sanitary reforms, regarding which the Board recorded their opinion that minor sanitary works had progressed very satisfactorily.
4. The prevalence of fever in the province, specially in swampy and water-logged areas, and the remedies that might be applied.

The income of the nineteen *Sadar* towns in the Central Provinces in 1896 was Rs. 16,26,680, and, excluding sums aggregating Rs. 80,778, which were spent on medical relief, vaccination and miscellaneous works, Rs. 2,79,252 were spent on sanitation, including

Rs. 52,420 on water-supplies, against Rs. 50,449 in 1895 ; Rs. 2,05,089 on conservancy, against Rs. 1,95,861, and Rs. 16,895 on buildings against Rs. 32,586.

The most important works carried out and in contemplation during the year were the following :—

Wardha.—The estimate prepared in 1895 for a scheme to supply the town with water by pumping from the river Paunar, was considered in May 1896. It was resolved to modify the scheme so as to include a service reservoir and so avoid pumping the water into the mains direct from the filtering stations.

Bhandara.—An estimate, amounting to Rs. 1,85,434, to supply the town with water by pumping from the river Wainganga was considered, and sanction was given to the preparation of a final estimate.

Jubbulpore.—Further progress was made with the completion of the water-supply works, on which about Rs. 32,000 was expended during the year.

Harda.—The experimental wells, begun in 1895, were finished, as well as filtration and sump wells, and a preliminary estimate for Rs. 19,575, to pay for lands occupied, head-works and approach roads, was sanctioned.

Khandwa.—The water-supply works were practically completed, and pipes were laid in the town at a total cost of Rs. 3,01,302.

A survey for a water-supply scheme for Chhindwara was completed ; a preliminary survey was undertaken at Bilaspur ; and, at Hoshangabad, a water-supply scheme on a small scale was under consideration.

Plans and estimates for a main out-fall drain for Jubbulpore City were approved, and a drainage scheme for Wardha was under consideration.

Considerable sums were realised by many of the towns from the sale of nightsoil, or from the lease of the lands in which it had been deposited.

The Sanitary Commissioner is the President of the Board, and the members are the Commissioners and certain district officials of the division in which a meeting is held. There were four meetings during the year, at Nagpur, Raipur, Jubbulpore and Pachmarhi, when proposals and estimates for schemes of sanitary improvement in the various districts were considered.

The total estimated income of the municipalities in Berar was Rs. 2,42,922, of which 74·2 per cent. was allotted for Sanitary Works and Rs. 1,70,515, or nearly 95 per cent. of the allotment, was actually spent as follows :—On water-supply, Rs. 71,180 ; on conservancy, Rs. 59,988 ; on drainage, Rs. 10,208 ; and on other sanitary works, Rs. 29,139.

No new work of magnitude was undertaken, but the Kapsi water-supply scheme for Akola was completed at an expenditure during 1896 of Rs. 35,598.

The year was a very dry one, and Dr. Little made a careful examination into the water-supplies of the various municipalities.

At Akola, where the water is derived from infiltration galleries at Kapsi, ten miles from the town, the water fell so low in the upper gallery that it was necessary to pump water from the lower gallery for the supply of the town. A chemical examination of specimens of the supply taken at the gallery and from a stand-post in the town, shewed that the water was of fair quality, and that in its passage along the closed pipes the water had gained slightly in total solids and chlorine, while it had lost free ammonia.

Amraoti camp is supplied with water from a tank at Wadali, the water being derived from an unpolluted catchment area. There are two filter beds, passage through which appears to greatly improve the potable quality of the water. There is a considerable village near the tank ; this Dr. Little considers a source of danger and has recommended its removal.

Amraoti City is supplied from a tank fed from a conserved catchment area in the Amraoti hills. The water is supplied without filtration. Specimens of water taken from the tank and from a stand-post shewed that the water, during its passage through the pipes, gained considerably in total solids, while the free and albuminoid ammonias were considerably diminished.

Khamgaon derives its supply from the Januna tank, about two miles from the town. The catchment area is about 800 acres in extent and is unpolluted. Examination of the water shewed a considerable amount of organic impurity, believed, in the absence of chlorine, to be vegetable in origin.

Buldana obtains water from the Sutrabur tank, situated in a depression between low hills, about a mile from the town. The catchment area is chiefly grass land, but there are teak trees near the tank, and the large leaves find their way into the water. In this

case, although the water in the stand-post was slightly better than that in the reservoir, there was present a considerable amount of organic impurity of vegetable origin.

Only one of the water-supplies, that of Amraoti Camp, appears to be filtered before delivery ; most contain a considerable amount of sediment and organic impurity, and would no doubt be improved by the use of settling-tanks and filter-beds. But these improvements are perhaps, for the present, beyond the means of the communities concerned ; meanwhile the specimens of water at the time they were examined were probably less pure than in a year of normal rainfall ; and care is taken at the sources to prevent the ingress of dangerous impurities.

The street and house-sweepings are sold in most municipalities. In Basim the sweepings are stored in pits, which is said to greatly improve their manurial value. In most of the towns, the nightsoil is trenched or converted into poudrette, but the trenches are not cropped in all cases. The Sanitary Commissioner urges on Municipal Committees the importance of a proper disposal of town-refuse and nightsoil :

" The disposal of nightsoil and sweepings, if efficiently and diligently carried out, must result in " the satisfactory cleanliness of our towns apart from the money income it would bring, and I would " earnestly ask municipal bodies to give this matter a foremost place in their deliberations and work."

A sum of Rs. 1,06,834 was allotted by District Boards for sanitary works and Rs. 82,695, or 77·4 per cent. of the total was spent ; Rs. 28,850 on water-supply, Rs. 12,690 on drainage, and Rs. 37,217 on " domestic cleansing,"—mainly conservancy.

The District Sanitary Boards met six times during the year, once in each district. They considered the measures taken by local bodies to give effect to the recommendations of the provincial Sanitary Commissioner, and recorded their suggestion against each incomplete work. "One tangible result of this action is that, in 1896, a sum of Rs. 51,368 was spent " on sanitary improvements recommended in the Sanitary Surveys."

Proposals to legalise a system of village sanitation were circulated throughout the province, in order to elicit expressions of native opinion. In all, about seventy persons gave their opinions, and were unanimously opposed to any present legislative interference with the customs of the people, in connection with sanitary reform.

Excluding the presidency town, the total income of the remaining 58 municipalities in Madras, was estimated to amount, in 1896–97, to Rs. 33,25,370. The sum allotted to sanitary works was Rs. 16,00,203, or 48·1 per cent. of the total income, and the amount actually spent in the nine months ending with December 1896, was Rs. 9,72,097, including Rs. 2,91,747—little more than half the allotment, on water-supply ; Rs. 4,18,292 on conservancy ; and Rs. 1,93,958 on the improvement of sites. The municipal income of Madras City was Rs. 14,38,560, from which a sum of Rs. 4,48,826 was set aside for sanitation, and Rs. 3,58,466 were actually spent during the nine months, chiefly on conservancy on which Rs. 2,54,343 was expended, against only Rs. 2,976 on the improvement of water-supply.

The Sanitary Commissioner chronicles a noteworthy advance in the views of the majority of the Municipal Councils in Madras. Until recently they were content to provide means to get rid of sewage ; now, it appears, that more municipalities have signified their willingness to undertake public water-supply schemes than the Government are able to provide with grants-in-aid, and engineers. Meanwhile, however, in those towns where public supplies have been provided the old sources co-exist with the new. In this connection certain observations made by Dr. King are important and interesting.

" For example, in Madras in a native house of a respectable, but not wealthy, class having a public " water-tap within 10 yards of it, the supply per head was found to be eleven gallons from a well " in the premises, and 2·20 gallons from the public supply on observation carefully conducted and " extending over a period of ten days : in another instance where only the public supply was used, " the consumption was found to be 14·61 gallons per head—the experiment also extending over ten " days. Again, in such water works as have been formed in the mofussil, the works themselves do " not offer the facilities, nor have the municipalities the apparatus, nor, at present, the wish to largely " use the supply for municipal purposes. With the object of throwing some light on this important " and strictly sanitary question, I circulated to District Sanitary Officers forms asking for measure- " ments of the water-supply of households for seven-day periods, under the superintendence of " medical subordinates. For facilitating calculations an arithmetical table, and forms setting forth the " various domestic purposes to which water is put, were supplied. Altogether the results of 65 " observations extending over the required period were received. The total average shewed that the " amount required for domestic consumption, under the ordinary conditions of native life, was " 16·9 gallons per head per day. This represented water drawn in all instances by manual labour and " carried over varying distances, and it certainly would result, as experience elsewhere has shewn, " that when these difficulties were removed a large increase would be required."

During the year, water-supply works were completed and opened at Trichinopoly and and Dindigul; similar works were in progress in Conjeeveram and Kurnool; and schemes for Negapatam and Conoor were being prepared.

It seems that the water-supply works actually in use are not in all cases quite satisfactory, a state of affairs due, apparently, to defective supervision on the part of the Municipal authorities. The following paragraph quoted from the report of the Sanitary Engineer touches on this matter :—

"The works in operation at Adoni, Cuddapah, Madura and Tanjore were maintained in charge of "the Council throughout the year. Those at Dindigul were handed over to the Council in "September 1896, and those at Trichinopoly in October 1896.

"The following were visited during the year by the Sanitary Engineer, viz., Cuddapah, Dindigul, "Tanjore, and Trichinopoly, and Adoni by the Assistant Sanitary Engineer.

"It cannot be said that the result of the maintenance by the Council is altogether satisfactory. In "the first place there is no professional knowledge on the part of the Chairmen, and they naturally "look with suspicion on requests, the necessity for which they do not understand, feeling themselves "more or less at the mercy of the engine-drivers and overseers in charge. Fuel stock in some places "has been allowed to go much too low, and there is, in certain towns, a tendency to unduly reduce fuel "consumption to save money. The proper class of oil has not always been supplied when required. "Leave has not always been obtainable by the engine drivers, except under conditions which did not "allow of them availing themselves of it. At Adoni the overseer was removed to other duty, "and the water delivered to the town was almost undrinkable in consequence of the wrong working "of the filters.

"There was no detailed inspection of engine and boilers, as the Boiler Inspector was not appointed "during the year."

A scheme for sewering Madras received the sanction of Government, and preliminaries regarding the erection of incinerators for the disposal of rubbish have been settled. Considerable progress was made in the preparation of a drainage scheme for Cuddapah. Pending the introduction of drainage schemes into the municipal towns, efforts are being made by the Sanitary Commissioner to improve and extend existing methods of sewage disposal, and he appears to have achieved a considerable measure of success in certain of the towns. The total sum realized by Municipal Councils for the sale of nightsoil and town rubbish, which in 1895 was Rs. 24,755, rose to Rs. 28,484.

The movement inaugurated in 1894, on the advice of Dr. King, to obtain properly taught sanitary inspectors is progressing favourably. Fifty-two men obtained certificates in 1896; and the entertainment of at least one trained man has been made compulsory in each municipality. Twenty-eight Councils employ certificated Sanitary Inspectors. Four are employed by District Boards, and provision has been made in the budget for 1897–98 for the entertainment of five others. Meanwhile well educated men are coming forward for the special course of instruction.

The total estimated income of the District Boards in 1896–97 was Rs. 79,67,830, of which 8·4 per cent. was allotted to sanitary works, which shews a falling off, as compared with 1895–96, when 9·2 per cent. of the slightly higher total income was set aside for sanitary purposes. The decrease is due to curtailment of expenditure under the heads of education, medical relief and sanitation in favour of the upkeep of improved communications. The expenditure on education is said to be more or less fixed, so that sanitation goes to the wall. On the other hand, the more judicious expenditure of the funds provided for conservancy has been ensured, and the tendency of unions to regard the fitting up of lamps as the most important call upon their income successfully curbed.

The Sanitary Board was reconstituted during the year, and now consists of three members and a secretary—

President.—The Chief Engineer and Secretary to Government in the Department Public Works.

Members.— { The Surgeon-General with the Government.
A member of the Civil Service.

Secretary.—The Chief Assistant to the Chief Engineer.

The Sanitary Commissioner and the Sanitary Engineer are no longer members of the Board and are restricted to purely executive professional work. It is provided that no sanitary work estimated to cost more than Rs. 200, exclusive of the cost of site, shall be undertaken without the previous sanction of the Board.

During the year, the Board scrutinised plans and estimates for 72 municipal, and 87 local fund, works estimated to cost in the aggregate Rs. 2,75,331.

The total sum expended on original works in the municipalities in Coorg in 1896 was Rs. 4,935, the greater part of which was spent on a new lying-in hospital and drains in Mercara, and on the construction of a tank in Somvarpet.

The Department of Public Works also constructed a new well and improved and repaired others at a total cost of Rs. 432. The only scheme of importance in contemplation is that for the water-supply of Virajendrapet, for which a sum of Rs. 500 was placed at the disposal of the Executive Engineer to meet the cost of a preliminary survey.

The Board met four times, and, among other matters, considered :—

(1) Rules for the better sanitation of Coorg. It was resolved that rules should be framed, and submitted to the Local Government for sanction. It will not, it is stated, be possible to introduce such rules into all villages, as there are comparatively few of the sweeper caste in the province.

(2) A rough estimate for the water-supply works of Virajendrapet was submitted by the Executive Engineer. The sum of Rs. 75,610 was considered beyond the means of the municipality, and it was resolved to ascertain whether the amount could not be reduced to Rs. 50,000.

(3) The erection of coolie shelters on the Ghats. The President informed the members that Rs. 2,400 had been collected, that Rs. 600 more were expected, and that Government had sanctioned the grant of a sum equivalent to that collected, besides supplying the necessary timber free of cost. The selection of sites was decided, and it was hoped that the shelters would be ready for occupation before the bursting of the monsoon of 1897.

Excluding the presidency town, the total income in 1895–96 of the 168 municipal towns in Bombay was Rs. 55,22,074, against Rs. 47,49,303 in the previous year. A sum of Rs. 25,01,157, equal to 45·29 per cent., was allotted to sanitary works. As in 1894–95, the expenditure under every head was less than the allotment, but the actual sums spent were considerably larger than in that year ;—on water-supply, Rs. 6,47,329, against Rs. 4,96,543 ; on conservancy, Rs. 11,06,662, against Rs. 8,69,219 ; and on improvement of town sites, Rs. 2,22,905, against Rs. 2,15,979. The income of the District Boards was Rs. 40,05,823. Although the income was higher, the allotment for sanitation was less than in 1894-95, and the whole allotment was not spent. The sum assigned to sanitary works was Rs. 6,85,851, and only Rs. 4,71,536 were spent, chiefly upon the improvement of water-supplies, which absorbed Rs. 4,27,758.

The Bombay Village Sanitation Act has been introduced into every district, except Kanara and Upper Sind Frontier, and is now in force in 222 villages, including 59 in which it was brought into force in 1896. No new sanitary work of capital importance was begun during the year, and progress, generally, seems to have been retarded, chiefly on account of famine, but partly on account of the apathy or obstruction of Municipal Councils.

Progress was made with the water-supply works at Yeola, Surat and Ahmednagar, and improvements were carried out at Hyderabad. A survey of the town of Belgaum was made by an engineer employed by the municipality, and a water-supply project is being prepared by him under the advice of the Sanitary Board. Water-supply projects for Akalkot, Nasik, Viramgam, Hubli, Gadag, Dohad and Dakor were under consideration. Estimates for surveying the town of Sholapur, and the preparation of a plan and estimate for a drainage scheme for the western portion of the town, were sanctioned by Government. A drainage scheme for Sukkur was completed, but it was shelved by the Municipal Council. Drainage schemes for Hubli and Gadag were under discussion.

The number of meetings of the Sanitary Board is not mentioned, but they seem to have done a great deal of useful work during the year. Among other matters they advised regarding the water-supply of Surat and Rander, Malegaon and Islampur, and furnished a report on the water-supply works of Satara.

At Satara the filters may possibly be insufficient, but they are not properly worked, the means of distribution is very faulty and even dangerous, and there is no check on the expenditure incurred. The supervision of the works, it appears, is altogether inefficient, and the water supplied was reported unfit for drinking, whenever it was analysed, except in August. The Board advised the proper completion of the distribution system, the construction of filter-beds and a pure-water reservoir, and the delegation of the supervision of the Kos tank and supply channel to the Executive Engineer.

Regarding the attitude of Municipal Councils the Board write as follows :—

"Finally we would urge that Government should, from time to time, recognise, in some substantial "manner, by suitable titles of honour, any special exertions made by a prominent member of a muni- "cipality in pushing on water-supply and drainage schemes. Owing to the conservatism of natives, "to their great objection to direct taxation, and to the tendency of the Municipal Commissioners, "generally, to subordinate public to private interests, the position of any Commissioner who takes up "sanitary improvement is a thankless and laborious one ; and yet, without some one taking up the

" matter seriously, and pressing it continuously for a long time, it is hopeless to expect any munici-
" pality to overcome its own *vis inertia*. Where there is a question of a municipal appointment which
" might be got for a friend or relation, or where there is a possibility of appropriating municipal funds
" for a school, or something of that sort, every Commissioner will attend; but when it is a matter of
" public health, or sanitary improvements, even a quorum can seldom be got, unless it is a question of
" taxation, when again there will be a full meeting to *oppose* it. There are probably not half a dozen
" non-official Municipal Commissioners in the Presidency who have seriously taken up this
" unprofitable and almost hopeless task; and unless their exertions are in some way recognised, and
" influentially supported, it is only to be expected that they will fall off; and those Commissioners
" who might possibly in time be influenced by these exertions, will prefer to cast in their lot with
" the popular *rôle* of passive obstruction to sanitation, varied by occasional theoretic discussions."

The aggregate income of the various district and municipal funds in Burma, in 1896, was Rs. 71,10,986, of which Rs. 24,59,584, or nearly 35 per cent., was devoted to sanitary works of one kind or another, distributed as follows: to water-supply, Rs. 5,53,609; to conservancy, Rs. 5,74,335; to drainage. Rs. 3,60,505; and to "other " sanitary works," Rs. 9,71,135.

No new work of any magnitude has been undertaken and the following notes regarding the chief towns refer to work in progress rather than to new projects.

In Rangoon, the water-supply continues to occupy attention. The existing supply, although sufficient for present requirements in years of ample rainfall, is of bad quality, and is liable, not only to extensive vegetable pollution, but, as the number of people living on the catchment area is increasing, to contamination of a more dangerous kind; and should the rainfall be deficient, there would be serious scarcity. Deep borings have shewn that supplies from subterranean sources, at a depth of 200 to 300 feet, are ample in quantity, and in some cases, of good quality; but, so far, experiments conducted under the supervision of an expert from England, have not proved successful, and, of the various other schemes for increasing the supply that have been suggested, the most feasible is said to be the construction of a new lake in the neighbourhood of Thameing.

Sewage is removed on the Shone and Ault system, and most of the houses in the town are now connected; while, in the suburbs, the contents of latrines are removed to depôts connected with the sewers. Regarding the efficiency of the system, the following remarks, taken from the report on the working of the Rangoon Municipality, are of general interest:—

" Both the Municipal Engineer and the Health Officer report favourably on the Shone system of
" sewerage. The system is fully adopted in the *town* between Judah Ezekiel Street and Godwin
" Road; in Lanmadaw sewers have been laid, but house connections are not insisted upon,
" therefore only a partial benefit is derived. In the *town* east of Godwin Road there are 2,724 house
" connections and, consequently, the system is thoroughly efficient. No blockages of any kind occurred
" in the mains, and it is not thought at all likely that any blockage will ever occur in them. The
" engines and air-compressors have also given complete satisfaction: the addition of plummer blocks
" outside each fly-wheel has added to the efficiency of the engines, as they have enabled them to be
" worked more steadily and at a higher rate of speed.

" During the year 624,048,000 gallons of sewage were ejected at a cost of 1 anna 8·5 pies per 1,000
" gallons, which is a moderate rate. The Shone system in Rangoon has now been worked for years:
" it has stood the test of time and has withstood criticism both interested and disinterested. Its
" benefit to Rangoon is incalculable and can only be appreciated by those who lived in the *town* prior
" to 1890, and had to submit to the foul nuisances which then abounded in every street, and who had
" in the hottest night to keep every window closed or allow their houses to be rendered almost
" uninhabitable by the awful stench from passing night carts. The Committee of 1886, with a much
" smaller revenue than is now available, shewed considerable courage in embarking upon an
" expenditure of 30 lakhs for a drainage scheme on a system, which, until then, had not been tried on
" so large a scale, but the result has been a complete justification of the course the Committee then
" took, and the inhabitants of Rangoon owe a debt of gratitude to those who, in spite of considerable
" opposition, gave Rangoon a drainage scheme on a system that by its satisfactory working has proved
" a complete boon."

The reclamation, on a great scale, of low swampy lands on the east of the town continues in progress.

In Moulmein, a report on a water-supply scheme was considered by the Municipal Committee, but, although it was generally approved, some details require remodelling, and the loan of the services of an officer to do this has been asked from the Local Government.

At Prome, the filter-gallery connected with the pumping-station got out of order, and the Superintending Engineer of the Irrigation Department inspected it, in order to ascertain what alteration is required. In the meantime, water was taken direct from the river through a strainer, at a point which was considered by the Health Officer to be too near the bank.

At Bassein the question of a general water-supply is engaging attention. Experimental borings have been made, and water obtained from a depth of 280 feet, but not of good

quality. The night conservancy scheme has been extended, and no cess-pits now exist within the limits served, except those on the banks of creeks. The contents of 535 public and private latrines are removed daily in covered buckets and air-tight conservancy boxes, on tram trucks, to Pandingôn, situated about half a mile from the town, and there trenched.

At Mandalay, no water-supply scheme has, as yet, been undertaken. Experimental wells sunk in an old bed of the Irrawaddy to the north of the city yielded very hard water, and a scheme, to obtain water from the river near Amarapoora, is now being considered. The objection to this scheme is the liability to pollution from surface drainage of the town—a liability which will increase as drainage improves.

Except in remote districts, village sanitary inspection registers have been introduced, and after certain modifications in the form of the registers, shewn by experience to be requisite, have been made, good results of their use may be expected.

The Sanitary Board met once during the year and, with reference to a communication from the Local Government, made at the instance of the Government of India, resolved that, as eleven of the towns in the province were provided with complete maps, the time had come to appoint a Sanitary Engineer.

APPENDIX A.

RESOLUTION.

SANITATION DEPARTMENT.—*Dated Naini Tal, the 14th September*, 1896.

READ—

(1) Resolution No. $\frac{27}{V-10B.}$, dated 9th February 1889, in the Sanitation Department.

(2) Resolution No. $\frac{42}{V-10B.}$, dated 6th March 1890, in the Sanitation Department.

(3) Resolution No. $\frac{561}{V-10B.}$, dated 21st December 1893, in the Sanitation Department.

OBSERVATIONS.—In the first of the Resolutions read in the preamble, the Government of these provinces explained the manner in which it proposed to give effect to the wish of the Government of India that for the furtherance of sanitary reform and for the guidance of local executive agencies in urban and rural areas a Sanitary Board should be appointed in each province, which should supervise and control all sanitary works in progress or projected; should initiate and direct the sanitary survey of each municipal and rural area; and should devise such simple rules for the improvement of village sanitation as experience might shew to be necessary and practicable. The Sanitary Board established in these provinces by the Local Government, in pursuance of this policy, was tentatively constituted as a consultative and not as an executive agency. It was charged with the duty of instituting a sanitary survey of the province, and especially of ascertaining the localities in which the presence of canals or railway systems made large schemes of drainage necessary. It was required to report on the best methods of introducing sanitary reforms in rural areas; and it was made the referee and adviser of Government on all questions specially remitted to it for opinion by the Government, the Sanitary Commissioner, or Commissioners of Divisions.

2. The Board thus constituted has done useful work. It has assisted the Government in improving the provincial system of mortuary and birth registration. It has reported from time to time on the drainage requirements of the country. It prepared the first draft of a village sanitation Bill which eventually was enacted by the Provincial Legislative Council, and it framed the rules by which effect is given to the Act. This Act marks the first stage in the improvement of the sanitary condition of rural areas. But it is as yet in force in only eight districts, and even in those districts it can be applied only to villages with a population of 2,000 and upwards. The general problem of rural sanitation is scarcely touched by it, and the preliminary measure of a detailed sanitary survey of each district has not even been commenced. The time has come, in the Lieutenant-Governor's opinion, for a fresh advance on the lines of the policy laid down by the Government of India in its Resolution of 27th July 1888. His Honour has therefore decided to strengthen the Provincial Sanitary Board, and to increase its powers; and he proposes to create, as time goes on and funds become available, an efficient sanitary agency in each district, to co-operate with the Sanitary Board.

3. With regard to the Sanitary Board, the following rules, which will take effect from the 1st November next, will regulate its constitution, procedure, and powers:—

I.—The Sanitary Board of the North-Western Provinces and Oudh shall consist of the following permanent members, of which three shall form a quorum:—

(1) The Inspector-General of Civil Hospitals ... ... *President.*

(2) One of the two Secretaries in the Department of Public Works as the Lieutenant-Governor may from time to time nominate.

(3) The Sanitary Commissioner.

(4) The Sanitary Engineer ... ... *Secretary.*

II.—The Board, in addition to such meetings as may be needed for the despatch of ordinary business, shall sit once a year in each revenue division, and, when sitting in a division, shall have as additional members—

(*a*) Commissioner of the Division.

(*b*) The District Magistrate ... ... }
The Civil Surgeon ... ... } of the district whose sanitary business
The District Engineer ... ... } is being considered at the time.
A delegate from the District Board ... ... }

When the sanitary business of a municipality is under consideration, a delegate from the Municipal Board and the Municipal Engineer (if any) shall take the place of the District Board's delegate and the District Engineer.

III.—The Board shall keep minutes of their proceedings, and these will form the basis of a chapter in the Sanitary Commissioner's Annual Report.

IV.—At the commencement of each year the permanent section of the Board shall draw up a programme for the year, fixing the dates and places of meeting, and notifying any important subjects which may be for consideration in each division. It will not be possible to notify beforehand the detailed proposals which district authorities may have to bring forward. References from Government in local sanitary matters will be considered at these meetings, and plans adopted.

V.—Under rules about to be issued to define the procedure of Municipal Boards with regard to the preparation and execution of public works projects, the Sanitary Board will be the adviser of the Commissioner of the Division as to whether administrative sanction should be given or withheld when projects of a sanitary character are submitted to him for sanction. With regard to sanitary works undertaken by District Boards, the Sanitary Board will give administrative sanction to all works towards the cost of which it may contribute from funds placed by Government at its disposal for this purpose. It will also advise the Commissioner of the Division as to giving or withholding administrative sanction to all other projects of a sanitary nature proposed to be executed out of the District Board funds alone when the estimated cost exceeds Rs. 1,000 and does not exceed Rs. 10,000.

These rules, it is hoped, will bring the Sanitary Board into close relations with the district administration, and enable it to supervise and guide the general progress of rural sanitary reform.

The next step is to lay down the lines on which the executive sanitary agency in each district should work. As regards this agency, the chief sanitary officer of each district will be, as he is at present, the Civil Surgeon. He has now at his disposal the subordinate staff of the Vaccination Department from the Assistant Superintendent downwards, and he may utilize their services for sanitary work throughout the district so far as their vaccination duties and their qualifications permit. But it must be admitted that the subordinate staff of the Vaccination department at present know little or nothing of sanitation, and that in this regard small help can be expected from it. If sanitary progress is to be made in rural villages, the *personnel* of the staff must be improved. Measures are contemplated which will strengthen this staff and make it more competent for the combined work of vaccination and rural sanitation. In the larger districts, where the duties of the Civil Surgeon are heavy and multifarious, it is proposed at once to give him the services of an Assistant Surgeon as Sanitary Assistant, and the intention is eventually to post such an officer to each district. Financial reasons may for some time compel the Civil Surgeons of the smaller districts to dispense with this special assistance, but it is thought that without it some progress may be made in the preliminary work of a detailed sanitary survey of rural areas, with the co-operation of the revenue district staff under the orders of the Collector. In view of the increased attention which under such a survey mortuary and birth registration will require, it may be necessary to give the Civil Surgeon more clerical assistance in this branch than he has at present. The Sanitary Board will be consulted on this point.

5. The first step in the sanitary survey of a district is to group the villages, for purposes of detailed and continuous observation, into smaller registration areas than the present *thana* circles. The sub-circles thus to be formed in each existing rural circle are intended exclusively for district sanitary work; for all statistics returned to the Sanitary Commissioner the *thana* circle will remain the unit. In forming the sub-circles the following rules should be observed :—

(1) Municipalities, cantonments, and Act XX. towns will be excluded, as they already form separate units.
(2) A sub-circle should, if this be possible consistently with the provisions of rule (4), contain not less than 10,000 and not more than 15,000 inhabitants, the lower limit being suitable for sparsely inhabited and the higher for populous tracts.
(3) A sub-circle should be compact and, so far as possible, homogeneous in physical and hygienic character.
(4) A sub-circle shall not extend into two *thánas*.
(5) A sub-circle, so far as is compatible with the preceding rules, should include entire *patwári* circles.
(6) The sub-circles should be numbered, a single series of numbers for the whole district being used.

6. The Civil Surgeon, in blocking out these sub-circles, should consult the Collector, who, in giving the requisite assistance, will utilize the local knowledge of tahsildars and kanungos and other members of the district staff. The object to be aimed at is to so group the villages of each *thána* that the grouped villages may present fairly like conditions of health, and the group represent a real unit. The mortuary and birth returns of groups so formed will have an import in connection with the localization of disease and insanitary conditions which those of existing *thána* circles cannot have, and the intelligent study of these returns by the Civil Surgeon and his Sanitary Assistant will be the first step in the direction of systematic sanitary reform in rural areas. An effort should be made to have the sub-circles blocked out and numbered in each district before the 31st December next, so that from the 1st January 1897 births and deaths in each *thána* may be recorded in separate registers for each sub-circle, and separately returned month by month for each sub-circle to the District Registrar. The Sanitary Commissioner will be asked to frame such subsidiary instructions as may be necessary for the guidance of circle registration officers. He will also be asked to say whether it would be possible to compile from the *thána* registers mortuary and birth statistics for each group for each of the past five years, so as to at once give the Civil Surgeon, as chief sanitary officer of the district, a basis of fact from which to work.

7. The investigation of the sanitary condition of each circle will follow. In districts to which it is found possible to attach a Sanitary Assistant to the Civil Surgeon, he will be employed by the latter as his chief inspecting officer. In these and other districts the Civil Surgeon will also utilize the Assistant Superintendent of Vaccination and his subordinates, and will have the assistance of the district staff, and all reports by the members of the staff on the sanitary condition of villages will be sent to him by the District Magistrate to be collated and recorded in a permanent register. It will be his duty to bring all these reports to a focus, and to work them up into a shape in which they may be submitted to the Sanitary Board. When worked up, the reports should be very brief and more in the form of notes on the various villages, under heads to be prescribed by the Board, than of descriptive narratives. For preparing these reports the Civil Surgeon may, as has been already remarked, require more clerical assistance than he has at present. An Assistant Magistrate in training, or other available member of the district gazetted staff, may be very usefully employed in aiding the Civil Surgeon in this connection.

8. The sanitary improvements which this investigation into the condition of rural areas may suggest will fall into two classes. The first class are those which concern the construction or repair of wells and tanks for drinking water and the drainage of the village site, and which require some expenditure of money. The second are those which merely involve the observance of simple sanitary rules or the exercise of a little energy on the part of owners and occupiers of the village. The funds for the first class of improvements will be provided by the District Board ; by grants-in-aid from the Sanitary Board within the limits of the sum which Government may be able annually to assign to that body ; by moneys leviable under the Village Sanitation Act ; and by local contributions. The amount which a District Board can spare from its funds for rural sanitation may not, to begin with, be large; but some provision, however small, should, in future, under the proposed scheme of local finance, be made for this purpose in every District Board budget. The Local Government will, when the state of the finances permits, make an annual grant-in-aid of rural sanitation ; and the Lieutenant-Governor and Chief Commissioner hopes that public liberality will also assist to the same end.

9. As regards the second class of improvements, which may generally be described as connected with the preservation of the village water-supply from pollution and the village site from being befouled, these require nothing more than the observance of simple sanitary rules by the village community. Again, the filling up of pits and stagnant pools within the village site, the clearance of jungle from it, and the execution of simple repairs to wells and tanks by the persons owning or using them, require only the contribution of a little assistance in materials and labour, or the expenditure of a little labour which hurts no one, and will, if the matter is gone about in the proper way, be willingly given. The appointment of places for the deposit of manure and household refuse, the regulation of burials and of the practice of offensive trades—these and similar matters will in due time, when village opinion is ripe, be brought to the notice of the village *panchayat*. At present the law does not empower the District Magistrate, except in the comparatively few villages to which the Village Sanitation Act has been extended, to enforce rules on these points. But much has been, and is being, done in many districts by persuasive executive action to introduce and render sanitary rules effective, and what the Lieutenant-Governor desires is that, pending the amendment of the law in this respect (should amendment eventually be found desirable), the District Magistrate and the District Board will co-operate with the Chief Sanitary Officer of the district in extending the observance in villages of simple sanitary rules, of proved utility. It will be open to the Provincial Sanitary Board to examine such rules and to suggest such improvements as experience may dictate. But here it may be said, for the Board's general guidance, that they should discourage rules and works which are not of a simple character. No attempt should be made to introduce the latrine system, and what is done, or attempted to be done, should be unpretentious, agreeable to the feelings and wishes of the people, and in general harmony with existing village practice.

10. The promotion of sanitation in municipalities will be equally within the functions of the Sanitary Board, and at its meetings the wants of municipal areas will be considered no less than of rural areas. But as municipal funds are fairly adequate to town wants, while the supply of money of rural sanitation must for many years fall short of the demand, no contribution should be made in aid of municipal resources from the funds placed at the Sanitary Board's disposal.

General Remarks.

Red Sea Pilgrim Traffic.—The following short summary of the main facts regarding the Red Sea pilgrim traffic in 1896 is taken principally from the Report forwarded by the Health Officer of the Port of Bombay.

During the year there left Bombay for Jeddah, nineteen steam vessels of the usual class which provided accommodation, on the scale laid down by the Native Passenger Ships Act, for 14,478 adults. The total number of pilgrims who left Bombay, excluding 311 passengers for intermediate ports, was 14,167, comprising 13,230 adults, 764 children between one year and twelve years of age, and 173 infants. The average duration of the voyage, excluding detention at Camaran, was 14 days. The total number of pilgrims who were admitted to hospital while at sea was 271, and of these 49 died, including 18 whose deaths were ascribed to general debility, 3 of old age, 2 of small-pox, and 1 of choleraic diarrhœa.

The new Pilgrim Ship Act of 1895 was brought into force from the 6th of October 1896. This Act, among other provisions, requires that each pilgrim shall have six feet square of free space upon the upper deck, in addition to either 12 square feet on the 'tween decks, or 16 square feet on the orlop deck. To ensure thorough ventilation, it is

also required that, besides hatches and scuttles, each pilgrim on the 'tween decks shall be provided with 5 square inches of ventilating opening and each pilgrim on the orlop deck with 10 square inches. Five vessels left after the new Act came into force, but no pilgrims were carried on the orlop decks.

The medical inspection of the pilgrims was carried out as usual, valuable assistance being rendered, especially after the new Act came into force, when the inspections were more tedious and complicated, by the officials of the Preventive and Police services.

The quarantine station at Camaran was opened on the 18th December 1895, and the usual quarantine of ten days was imposed on all pilgrim-ships arriving just prior to the Haj, which took place on the 23rd of May.

On the return voyage to Bombay there were engaged nineteen vessels providing accommodation, under the law, for 15,222 adult pilgrims. At Jeddah 11,133 pilgrims embarked, and at Camaran 63. At Aden and Karachi 1,363 pilgrims disembarked, and 9,697 were landed at Bombay.

As usual, the homeward voyages were much the more unhealthy. There were 365 admissions among the returning pilgrims and 136 deaths, including 34 from debility, 21 from senile decay, 19 from choleraic diarrhœa—against only one in the outward voyages—and 14 from chronic dysentery.

In 1896 the difference between the total number who went to the Hejaz and the numbers that returned was only 15 per cent., against 28 per cent. in 1895, and an average in former years of about 33 per cent.

No vessel left either Calcutta or Madras for the Hejaz, but the S.S. *Sultan* arrived in Calcutta from Jeddah on the 23rd of June. She had on board 1,112 pilgrims, and there had been 44 deaths during the voyage, including 13 from diarrhœa, 11 from lung diseases, and 7 from small-pox.

Researches by the Special Assistant.—During the latter part of the year 1896 and the first few months of 1897, the work which was done in the laboratory attached to the office of the Sanitary Commissioner was mainly devoted to investigations into the question of the alleged occurrence of plague in Calcutta, and to the continued elucidation of certain points in connection with the physiological action of snake venom and the nature of the artificial immunity from which is established under the influence of continued and cumulative introduction of the toxin into the animal organism.

Shortly after the existence of plague had been recognised in Bombay, it came to be currently believed that cases of the disease had been detected in Calcutta among both the civil and the military population. The observers who were primarily responsible for the origin of this belief did not affirm that they had any satisfactory clinical evidence for it, and founded their diagnoses solely on the results of microscopical examinations and cultivations of specimens of blood derived from the bodies of the suspected patients. The matter was one which, from its important bearing on mercantile interests, could not be allowed to remain undecided, and a careful investigation into the nature and value of the bacteriological evidence which had been adduced in regard to it was accordingly undertaken.

A series of type specimens of blood and hæmatic cultivations from suspected cases was accordingly procured and submitted to careful examination and comparison with specimens and cultivations prepared in the laboratory, and the data which were thus obtained were of a nature which appeared clearly to justify the conclusion that the bacteriological evidence which had been brought forward in support of the alleged prevalence of plague was entirely insufficient and fallacious. The grounds for this conclusion were the following :—

1. The schizomycete organisms which were present in the type specimens of blood were not invariably of the same nature.
2. In many instances they presented no morphological resemblance whatever to typical plague bacilli ; in some they were unequivocally mere accidental contaminations of aerial origin ; and, in others, what had been regarded as schizomycete organisms were apparently mere products of nucleoplastic disintegration.
3. The growth in the various type cultivations were not of any uniform character, and some cultivations contained growths of more than one kind of organism.
4. Specimens of blood taken under proper precautions from certain of the alleged cases of plague showed no evidence whatever of the presence of any intrusive schizomycetes, and corresponding cultivations entirely failed to yield any growths.

5. A very brief exposure of the blood of perfectly healthy animals to free contact with the air of the laboratory was sufficient to secure the subsequent appearance in them of a number of distinct forms of schizomycetes, some of which were absolutely identical in characters with those present in the type-specimens of blood and the type cultivations derived from the alleged cases of plague.

Full details in regard to the results of the experiments dealing with snake venom will appear in a forthcoming number of "Scientific Memoirs by Medical Officers of the "Army of India," and, in the meantime, it may be sufficient to mention that they conclusively demonstrated that the artificial immunity attending repeated and cumulative injections of venom persists unimpaired throughout periods of many months' duration, and afforded additional evidence in support of the view that the phenomena attending intoxication by cobra-venom are primarily dependent on the occurrence of important changes in the constitution of the blood, and not on any direct action of a toxin upon the nervous apparatus.

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ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1896.

(Surgeon Lieutenant-Colonel W. G. King.)

General Population.

Vital Statistics.

The population for which birth and death registration returns were received in this office during the year amounted, according to the census, to 32,761,209—or 91·9 per cent. of the total of 35,641,828 ascertained on last census. Allowing for the intercensal rate of increase, the population under registration amounted to 36,656,033 on the 31st December 1896. Taking the net result of emigration and immigration statistics for the year under report, it is found that the Presidency lost 32,833 souls.

System of birth and death registration.—The system of registration of births and deaths in the Madras Presidency continued the same as in 1895, but under Order No. 476, Revenue, dated 21st September 1896, the following changes were sanctioned :—

(1) Candidates for the public service and school boys, who were born in municipal towns in which the compulsory system of registration has been in force for many years, should be required, after a certain date, to produce attested extracts from birth registers.

(2) That the number of Union and Municipal registrars be calculated with reference to the population and area of the municipal towns and unions.

(3) That printed forms [in lieu of existing loose forms] bound into books be supplied to all registrars.

(4) That steps be taken to punish negligence.

(5) That special inducements be offered to all municipal servants for reporting cases of unregistered births or deaths.

In other respects, the system remains as described by me in my report of 1893.

The inspection report forms used by District Medical and Sanitary Officers were revised by me so as to require further attention to the details of registration. Information gathered from these sources, together with that secured by personal inspections by my Deputy and self, was duly forwarded with remarks to the Collectors of the districts concerned, who, in all cases where neglect of duty by Village Heads was proved, took action to prevent a recurrence of omissions. In the month of October 1896, having regard to the approaching scarcity, a special circular letter was forwarded to Collectors advising increased attention to the question of correct registration.

The birth and death rates for the whole Presidency were 29·9 and 20·6 per 1,000 of population respectively, as compared with 29·1 and 19·6 in 1895.

In rural areas 904,112 births were registered: the birth-rate for the Presidency as registered was therefore 29·9 against 29·1 of 1895 and 27·2—the average of the previous five years.

The natural increase of the population of the districts, as a whole, was 35,144,977. Reckoned upon the "estimated population," the birth-rate was 26·7 per 1,000 of the population, or 0·3 per 1,000 less than registered during 1895. A further method of correction is legitimate in attempting to gauge the birth-rate of the Presidency or—to put the matter in more exact terms—the efficiency of registration; namely, by excluding the districts of Ganjám and Vizagapatam, where, on account of large tracts being up to date under the administration of zemindars, the statistics are markedly less reliable than elsewhere. If a calculation be made on this basis, it is found that the birth-rate of the Presidency for 1896 was 30·0 when reckoned upon the Census, and 27·4 upon the "estimated population."

The births of boys were in the proportion of 104·8 to every 100 girls. The months in which the greatest numbers of births occurred were July and August, which allowing for an average interval would indicate the influence of the favourite marriage seasons of Chitrai, Vaikasi and Ani corresponding to the months of April, May, June and July.

There was a decrease of the births in 1896 in 9 and an increase in 12 of a total of 22 districts.

Seeing that it is well recognized that up to date it has not been possible to secure, in tracts of the country where registration is not compulsory, any approach to the normal birth-rate, as proved by the ascertained intercensal rate of increase, it is a matter of

difficulty to decide how far the decrease in 9 districts is due to carelessness in registration, and how far to actual diminution in the number of births. So far as Revenue authorities are concerned, I should feel inclined to believe that the pressure brought to bear upon them by Government has been productive of greater zeal on the part of village heads. The only factor which, it is easily recognised, would have operated adversely, as to zeal in registration, is the steadily decreasing number of rural inspections (under the influence of G.O., No. 57, Public, dated 24th January 1895), effected by District Medical and Sanitary Officers, seeing that, when the rates obtained from areas where registration is compulsory are regarded, there is no evidence forthcoming that the decrease in births has been real ; on the opposite, municipalities, as a whole, shew a decided increase. Against this, however, it might be pleaded that the town and municipal populations, irrespective of age constitution, cannot, in all respects as to vital statistics, be considered fairly comparable. Thus, having regard to the advent of an "evil cycle," in which it is prophesied by Hindus that famine and pestilence will affect the land, it is quite possible that marriages in the rural tracts have been postponed on the advice of astrologers during 1895-96. Again, it was the rural population that suffered chiefly during the famine of 1876–77, and in which, consequently, as the survival of the fittest, the people at child-bearing ages have since been predominant. As shewn by Mr. Stuart, the rate of increase between the Census of 1881 and 1891 was thus beyond what might normally be expected. Taking into account the probable child-bearing period of the Indian, it may now well be that we are entering upon a period when a fall in the rural birth-rate must be expected. But, whilst some influence from these factors may be conceded, it must be held that, if there has been no decrease of activity in registration of births in these districts there has at least been no increase, seeing that between the rate as registered and the actual birth-rate, even if such allowance be made, there is an enormous gap.

In Ganjàm, Vizagapatam and the Nilgiri districts, a considerable improvement in tracts long notorious for slackness in registration has occurred. The advance accomplished by South Arcot is noteworthy, and significant of the interest in matters sanitary, generally taken in this district. On the other hand, Malabar shews even worse results than in former years.

There were 75,869 births registered in municipalities, yielding a ratio of 36·1 per 1,000 of the census population, and 33·2 of the "estimated population," against 35·3 and 32·8, respectively, during 1895. The births of boys were in the proportion of 104·9 to every 100 girls—a very close approximation to the rural rate.

Out of 59 municipalities there was an improvement in 34, and in 23, namely, Anantapur, Adòni, Coimbatore, Karùr, Chicacole, Berhampur, Ellore, Masulipatam, Bezwada, Kurnool, Madras, Dindigul, Palni, Cannanore, Nellore, Vellore, Tìruppattùr, Negapatam, Mannàrgudi, Tinnevelly, Palamcottah, Srìrangam, and Anakapalle there was a falling off.

The following statement exhibits the incidence of death causes in the whole Presidency per 1,000 of population" :—

Years.	Birth-rate per 1,000 of the estimated population.	Death-rate per 1,000 of population.						
		Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other causes.	Total.
1891	27·4	3·5	1·4	7·3	1·0	0·3	9·4	22·2
1892	25·1	2·3	1·3	8·3	1·0	0·3	9·0	22·3
1893	27·0	1.0	0·8	7·7	0·7	0·3	8·8	19·3
1894	27·7	1·3	0·3	8·0	0·7	0·3	9·3	20·0
1895	29·1	0·6	0·1	8·2	0·7	0·3	9·5	19·6
1896	29·9	1·5	0·3	7·9	0·7	0·3	9·8	20·6

The total death-rate was therefore slightly above that of the preceding year, which was the healthiest for a period of eight years. The infantile death-rate was 163·0 per 1,000 of births registered.

In rural areas 611,201 deaths were registered, yielding a ratio of 20·0 per 1,000 on the census, and 17·8 on the "estimated population," against 19·0 and 17·6, respectively, of the year 1895, and 20·0, the average for the previous five years.

During the last quarter, famine conditions prevailed in the Deccan Districts. Labour was, however, promptly supplied by Government. Under the influence of drought, malarial fevers declined. Hence no increase of gross mortality is demonstrable ; but, in certain areas of the affected districts, the death-rate rose with respect to the susceptible ages of from 1 to 4 and above 50 years.

The death-rate in the total municipal towns amounted to 30·7 per 1,000 of the census, and 28·2 per 1,000 of the "estimated population." The increase of mortality beyond that of 1895 occurred chiefly under the head of cholera. In the case of only 15 towns was any decrease of total mortality noted when compared with that of 1895 ; of these, the decrease of death-rate synchronous with increased birth-rate of Cuddapah was most noteworthy. The total infantile mortality was 232·9 per 1,000 of births, against 223·0 of the previous year.

Chief Diseases.

Cholera.

A total of 47,847 persons died of cholera during the year under review, or 1·5 per 1,000 of the estimated population. This was considerably in excess of the incidence of this disease last year, when the rate registered was 0·6 per 1,000. Nevertheless, this heavy mortality compares favourably with that of such recent periods as 1891 and 1892. Certain districts suffered out of all proportion to others. Thus, Bellary, lost a total of 4,205, and Coimbatore 10,731, or 4·7 and 5·4 per 1,000, respectively, of their populations. In Malabar, Bellary, South Arcot and Tanjore cholera was present in each month throughout the year.

The mortality in municipalities from this disease was at the rate of 2·1 per 1,000 of the population, there being a total of 4,371 deaths. The towns of Tiruppattúr and Vániyambádi contributed 556 deaths, yielding a rate on their small populations of 16·2 and 18·2 per 1,000 respectively. In paragraph 46 I have referred to the fact that there is a regrettable tendency on the part of councils to delay taking the necessary steps under G.O., No. 1536 M. of 9th September 1896, with sufficient promptitude for the combating of cholera. Unless councils can be taught to take a pride in being absolutely prompt in appointing the necessary staffs, instead of pursuing the impotent method of saving a few rupees at the commencement of an epidemic whilst waiting till they are *quite sure* cholera has established a firm foothold in their towns, I need not say that, irrespective of the favouring influence of the evil conditions of water-supplies in most of them, loss of human lives from this preventible cause is inevitable.

Small-pox.

With few exceptions, deaths were reported from small-pox in each district in each month of the year. Nevertheless, in only four districts—Anantapur, Ganjám, Kurnool, and North Arcot—did the mortality exceed 0·3 per 1,000 of the population. The total deaths amounted to 8,867 in rural areas. In municipalities the death-rate upon the estimated population from small-pox amounted to 0·2 per 1,000, representing a total of 543 deaths. The incidence of small-pox mortality did not exceed 0·5 per 1,000 in 50 of the total towns. The brunt of the mortality was, however, borne by the towns of Vellore and Gudiyattám, amounting to 5·3 and 2·1 per 1,000 respectively. In the case of Vellore, the Municipal Council must, in great part, be held responsible for the mortality which occurred, as they neglected, in spite of remonstrances, to enforce vaccination, assigning as their reason that they considered this operation inappropriate during the existence of small-pox—a want of action that was duly condemned by Government on my bringing the fact to its notice. In the case of Gudiyáttam from enquiries on the spot, there would seem to have been at first a want of appreciation of the efficacy, and necessity for re-vaccination.

Fevers.

The incidence of fever on the population varies but slightly from year to year. The death-rate of 1896 (8·0) shews a decrease of 0·3 compared with 1895, and we have to go back to 1891 to find an equal decline. Both these years of small fever incidence were, as in the case of 1896, periods of deficient monsoon in the Ceded Districts, where malarial fevers are largely prevalent. In the case of Cuddapah, there were 2,292 deaths less registered from this cause alone.

In municipal towns, a satisfactory decrease occurred in Cuddapah, and a less marked but still appreciable decrease is evident in the case of Madras. In the former, the decrease must be ascribed to conditions common to it and the district—to which I have already alluded ; in the case of Madras, nearer approach to the normal sub-soil water level than

has existed since the exacerbation of malarial fever prevalence attracted attention, namely, in 1890, has, in my opinion, resulted in a decline of the fever rate. On this matter, a special report has, at its request, been submitted to Government. The town of Karúr exhibited a heavy increase of mortality from fever during the year, namely, 16·5 against 10·6 of 1895. In this case the sub-soil of the town is saturated with soakage from cess-pools, and as typhoid is a recognized disease in this town, it need not be assumed that solely malarial fever was dealt with.

Dysentery and diarrhœa.

The death-rate for dysentery and diarrhœa (0·7 per 1,000) shewed little difference in rural areas when contrasted with that found in 1895. Chingleput took the lead with a death-rate from this cause of 2·1 against 1·9 of last year. This district is notorious for bowel affections. This increase may be due to a better rainfall in certain parts of the district than it has had for some years past, bringing about access of water to tanks from more than usually distant parts, and with it filth, that would have been out of range of influence in ordinary years, or to fluctuation of the sub-soil water beyond normal limits. It is probable that much of the so-called dysentery and diarrhœa of South Canara and Malabar is due to catarrhal inflammation of the intestines following exposure to wet, which must form a prominent feature of the every-day life of the labourer in these districts. The rate for municipalities, as a whole, was 3·8 per 1,000 against 0·7 in the case of districts. With the exception of Coonoor, Guntùr, Coimbatore, and Vizianagram, no municipality shewed a marked increase of rate above the preceding year, whilst there were several noteworthy decreases, namely, in the case of Karùr, Chicacole, Rajahmundry, Palni, Tirupati, Mangalore, and Vizagapatam.

Injuries.

A total of 10,822 deaths was recorded from injuries which affords the invariable figure 0·3 per 1,000 of the population—a ratio which demonstrates the well-known fact that the occupations of the population vary but little from year to year, and that consequently the chances of injuries are the same even to subjection to deaths by snake-bite. Not until huge manufacturing or mining enterprises are started in the Madras Presidency is this curiously definite figure likely to vary from year to year. When this occurs, not only will the ratio for injuries alter, but also for suicides, as a result of change of habits and nature of demand upon the nervous system.

Sanitary Works.

Municipalities.

Including Tiruvannàmalai which was formed into a municipality in October 1895, and Chingleput made so in the latter part of the year under report, there were in all 59 municipalities. These embrace a population of 2,153,921, or 6 per cent. of the total population of the Presidency. As the District Boards Act (Act No. V of 1884) is of very little use in respect of sanitary provisions, it may be said that practically the population stated represents the total subjected to constant sanitary discipline. It cannot be said that the rate of sanitary progress in municipalities is such as to render the sanitarian sanguine. Still progress is apparent, and, this being so, it may be assumed that reforms will be introduced in an ever-increasing ratio, as one improvement is almost necessarily followed by another with the object of securing full results. Many legal difficulties that have been rendered apparent in the past, will be swept away by the Amended District Municipalities Act, which will come into force in 1897. Although there are certain municipalities which still remain unpersuaded as to the necessity for action in this respect, as a rule there is no doubt that the sanitary safety and convenience offered by public water-supplies are well appreciated ; indeed, more municipalities have represented their willingness to undertake schemes than Government can supply with grants-in-aid or the requisite engineering staff. This tendency I regard as a noteworthy sign of advance, as it is but a short time back they were well content that reform should commence by getting rid of sewage from the areas under their charge—regardless of grossly insanitary and repugnant forms of water contamination ; in reality not from any just appreciation of the sanitary results that might be expected, but with the object of aiding public comfort. Nevertheless, whilst it is fully understood that the obtaining of Government sanction for water-works will be of benefit to the people—works that are carried out at their expense, but do not depend upon their personal efforts for elaboration—it is extraordinary the apathy with which small measures which in the aggregate would do much to improve the general health of towns, and which are within the power of councils to accomplish, are frequently regarded. This results from the fact that the actions of most councils are trammelled by factions. A suggestion for a sanitary improvement from one of the " Opposition " is liable to be regarded as equivalent

to a vote of confidence in the Chairman and his party, it being a reflection on the sanitary administration of the town : and, if a proposal proceed from the party in power, it is equally likely to fall to the ground, because the Opposition feels it incumbent upon it to protect the pockets of the tax-payers and pose as their protectors from the influence of expensive changes founded upon mere theory. It is only in treating the advice of the Sanitary Commissioner that a really safe neutral ground is obtained : here both parties are not infrequently of opinion that the "least there is said the sooner it will be "mended;" suggestions from this source are very often buried in peace with the superscription "will be attended to." I, however, unfortunately for the peace of the councils, arrange for a resurrection of these proposals at intervals, by seeing that all promises of this description are duly registered in my office ; in the end, even with so unpromising a method of disposal, action is *occasionally* secured.

Acting upon the suggestion as to the backward state of conservancy in municipal towns conveyed in my Report of 1894, paragraph 63, Government called upon the Sanitary Board to draw up schemes for the various towns. As, however, the Board, instead of using the data at its disposal for excogitating schemes that might subsequently have undergone modification, on discussion by the councils, have referred the whole question to the councils without adding, as far as I know, any suggestions as to the lines to be pursued, it is very unlikely that any sweeping reform will take place at their hands ; for the reason that had they appreciated the necessity for such schemes the councils would, of their own accord, have effected these years ago. It cannot, however, be said that in the important matter of conservancy municipalities have effected no advance. Forty-two night-soil, 19 rubbish, 18 sewage carts, and 54 public latrines were added during the year, whilst an addition of 2,900 houses attended to under the private scavengering system was made. 147 toties and 49 sweepers were added to the menial staffs. Sanitary peons and sanitary maistries as well as Sanitary Inspectors underwent reduction, in conformity with the policy of introducing a better class—Certificated Sanitary Inspectors—to take the place of the numerous low-paid and ignorant men till recently employed on sanitary inspection work.

The rules for guidance of municipalities as to cholera prevalence were finally approved by Government (G.O., No. 1536-M., dated 9th September 1896). Their sphere of utility has, however, been much cramped by Government permitting discretion to local authorities as to employment of the staffs with the consent of the Collector. Collectors are very human in this matter, and are liable to assume a safety from loss of life that is the result of the wish being the father of the thought, and, consequently, efforts to convince municipalities as to the necessity for employment of full staffs are at times delayed. The staff advised by the committee which sat on this subject was regarded by it as the minimum requirement, and it seems to me that to permit municipalities with the self-confidence of amateurs to modify this staff "in the interests of economy," is a great mistake in the interests of life. In prompt action is really the key to ultimate economy. It may be held that in the exercise of the right of self-government a certain amount of discretion is advisable ; but it seems to me that the matter is of provincial not solely local concern, and that, if a council is determined to effect economy by providing inadequate staffs for epidemics, it should not be allowed to do so to the detriment of its neighbours. What I now say would doubtless apply with equal force to the rules for combating bubonic plague where much the same staff and arrangements are held to be requisite (G.O., No. 1985-M., dated 18th November 1896). Yet, if hesitation occurs in this case in any municipality, the consequences to the presidency generally would shortly become undesirably obvious.

I trust I may not be misunderstood as to economy. This is, of course, essential on all occasions when dealing with public money. But calculation shews that the expenses of meeting an ordinary epidemic of cholera under the system required is not beyond the means of a municipality, provided their funds are in all other respects carefully managed and *proportionately* spent, and when, in rare cases, notwithstanding this care, the council is in the unfortunate position of saying it really has no funds, it seems to me but reasonable that rather than they should employ inadequate measures the credit of the council should be pledged in obtaining a loan.

During the year the public water-supply works at Trichinopoly and Dindigul were completed and opened. Waterworks were also in progress at Conjeeveram and Kurnool. No improvements were made in the sanitary condition of the town of Madras, but a scheme for the sewerage of the city received the sanction of Government. Preliminaries seem to have been settled as to the erection of incinerators for the consumption of the town rubbish. The supply available to the inhabitants of the present unfiltered

and but partially protected water-supply in certain areas was rendered more constant by increasing the size and number of mains. Calicut erected a Silchar incinerator, and received sanction from Government for the conservancy-tramway suggested by me in 1893.

Pending the effecting of complete schemes of sewerage in municipal towns, it cannot be expected that much advance can be made as to sewage farming. Nevertheless, it has been pointed out to municipalities that much can be effected by extending existing systems sufficiently to serve suitable plots of land. Schemes for disposal by filtration of sewage from a small area of the town of Kumbakónam, and by improvement of existing arrangement at Tanjore, were discussed by the Sanitary Board during the year, but they have not been put into execution. Filtration of sewage is effected with good results at Vizagapatam previous to its entrance to the neighbouring swamp, where it was formerly a great nuisance, and at Vizianagram before entering into the Pedda Cheruvu. The former town has selected a place for a sewage farm, and has submitted a requisition under the Land Acquisition Act. At Vizianagram and Bellary filtration of sewage at households is also pursued with satisfactory results. At Rajahmundry the municipality opened during the year an experimental plot of one acre, which is cultivated by sewage that was formerly thrown hither and thither in waste places. The result, as I found on a late inspection, is a magnificent crop of vegetables, which are being sold at profit. The council now intends to extend the area. The plot taken up under ordinary systems of cultivation, would have been worthless, being almost solely sand. The sewage farm at Negapatam in Hathaway's Park continued to be a source of revenue to the municipality; Rs. 415 being realized from this source during 1895–96. Erode practised the cultivation of reeds successfully under sewage. The use of nightsoil and rubbish for cultivation advances in appreciation year by year. During 1895–96 the sum of Rs. 28,484 was realized by municipalities under this head against Rs. 24,755 during 1894–95.

The following statement shews allotment and expenditure for sanitary purposes during 1896:—

	1895–96.		Rate per cent. of expenditure to total allotment.	1896–97.		Rate per cent of expenditure to total allotment.
	Amount sanctioned.	Amount expended.		Amount sanctioned.	Amount expended in nine months end ng with December 1896	
	RS.	RS.		RS.	RS.	
For conservancy	5,22,271	5,04,288	96·4	5,78,110	4,18,292	72·3
For improvement of village or town sites.	2,48,987	2,34,335	94·1	2,90,069	1,93,958	66·8
For improvement of water-supply, cleansing, repairing, and construction of tanks and wells.	8,38,737	2,92,168	34·8	5,51,241	2,91,747	52·9
For sanitary arrangements during fairs and festivals.	5,440	6,518	119·8	36,970	9,619	26·0
For construction and repair of markets and slaughter-houses.	51,421	25,336	49·3	47,938	8,606	17·9
For other sanitary objects...	82,172	58,924	71·7	95,875	49,875	52·0
Total	17,49,028	11,21,569	64·1	16,00,203	9,72,097	60·7

The Sanitary Condition of Works and their Results on Public Health.—The following table is inserted by order of the Government of India, with the object of shewing the effect of public water and sewerage works in securing the sanitary end of decreasing mortality :—

Name of Municipality.	Date of completion of works of		Average annual death-rate since the introduction of drainage system or water-supply.		Average annual death-rate for the five-year period preceding the introduction of drainage system or water-supply.	
	Drainage.	Water-supply.				
			1893 ...	31·9	1888	28·4
			1894 ...	31·9	1889	26·9
			1895 ...	27·9	1890	42·7
Coonoor	January 1893	... ...	1896 ...	41·3	1891	37·2
					1892	37·0
			1893 ...	46·9	1888	31·7
			1894 ...	33·9	1889	30·5
			1895 ...	32·9	1890	43·0
Cuddapah	... ...	July 1893 ...	1896 ...	21·7	1891	27·0
					1892	38·3
					1889	34·8
			1894 ...	37·5	1890	31·6
			1895 ...	31·2	1891	33·1
Kumbakónam ...	October 1894	Do. ...	1896 ...	34·2	1892	29·1
					1893	36·2
					1889	31·2
			1894 ...	32·6	1890	32·7
			1895 ...	26·1	1891	35·7
Madura	... ...	April 1894 ...	1896 ...	23·2	1892	29·3
Madras	... ...	1872	1872 ...	35·2	1893	29·9
			1873 ...	36·7		
			1874 ...	36·6		
			1875 ...	35·6		
			1876 ...	39·6		
			1877 (Famine year.)			
			1878 ...	47·5		
			1879 ...	34·7		
			1880 ...	37·4		
			1881 ...	38·9		
			1882 ...	35·6		
			1883 ...	39·1		
			1884 ...	49·5		
			1885 ...	36·8		
			1886 ...	36·2		
			1887 ...	39.8		
			1888 ...	37·4		
			1889 ...	42·0		
			1890 ...	42·4		
			1891 ...	58·6		
			1892 ...	46·0		
			1893 ...	41·1		
			1894 ...	36·6		
			1895 ...	37·7		
			1896 ...	37·8		
					1890	19·2
					1891	44·5
					1892	34·7
			1895 ...	23·6	1893	22·2
Adóni	... ...	September 1895	1896 ...	25·4	1894	24·3
					1890	28·2
					1891	29·1
					1892	29·2
			1895 ...	25·5	1893	35·7
Tanjore	... ...	October 1895 ...	1896 ...	27·0	1894	26·9
					1891	41·4
					1892	20·5
					1893	23·5
					1894	23·7
Dindigul	... ...	August 1896 ...	1896 ...	23·1	1895	21·7
					1891	31·6
Trichinopoly ...	... ...	December 1896, but water supplied from April 1896.			1892	25·6
					1893	36·6
					1894	24·4
			1896 ...	30·4	1895	23·6

It cannot be said that results acquired so far are very striking. No other than a mediocre result from sanitary works in this Presidency can, however, be expected, so long as they are not constructed so as to involve not the major portion of towns but the whole, so long as the facilities afforded are not such as to permit of free use of the water by the inhabitants in all parts of the town and at all times of the day, and, above all, so long as the Municipal Councils persist in retaining the old wells and tanks which the public water supplies should have replaced.

Coonoor.—I remarked as to Coonoor in my last report that it might be hoped that sewerage works were about to shew an influence upon the death-rate; this hope has, however, been set aside by the vital statistics for 1896. The increased death-rate is due to dysentery. The actual number of deaths (44) was small, but materially swells the total rate when calculated on a small population. I invited the Medical officer's attention to the matter, but he is not in a position to ascribe any special cause for the increase under this head—further than the existence of the well-known factor of impure water-supply, which is quite sufficient to account for the condition. The Coonoor sewerage works cannot be said to be complete in any sense; they do not embrace the entire town; the house connections are incomplete, and sanitarily very imperfect. The discharge of the town sewage untreated into the Coonoor stream is, in my opinion, a possible source of danger to Méttupálaiyam.

Cuddapah.—In the malarious town of Cuddapah, a decided improvement is noticeable, and this is the more remarkable, in that lessened mortality has been attended with an increased birth-rate. In this town extensions have been freely effected by the municipality, and the public water-supply is fairly well adhered to by the people. All this looks hopeful, but, as in the district itself there has also been a marked decline this year from malarious fever, it is too early to draw decided conclusions, except to further exhibit the well-known fact that a decrease of malaria favours the increase of the birth-rate. Certain insanitary conditions of the head works were brought to notice by me during the year, and Government directed the more serious to be at once rectified.

Kumbakónam.—These works are of a very partial description and effect the removal of surface water only, although in addition they may have a slight influence on sub-soil water within a limited area; but no permanent effect upon the health rate of the town can be expected from these works.

Madura.—Until the opening of Periyár irrigation works threw into the Vaigai (from the bed of which stream, Madura derives its supply by infiltration) its surplus and wastage, it cannot be said that the supply of water in this town by the water-works was sufficiently continuous as to form a sanitary factor of importance. The municipality still maintains its old wells and tanks open for public use. The head works and adjoining areas were found in the same unsatisfactory condition as on my previous inspection; but, I believe, action has since been taken to remedy matters.

Madras.—I have, in former reports, pointed out that no sanitary work as yet undertaken by the Municipality of Madras can be regarded as having fully met sanitary requirements, and that even such works as exist are not in respect to details so complete as to cause their beneficial influence to be felt in perfect measure. A decrease of the death-rate occurred in 1896, but this may fairly be ascribed to a return to a more normal condition of the sub-soil water level in a town where, on account of the filthy condition of the sub-soil, fluctuations are of peculiar importance.

Adóni.—The errors pointed out in the last report as existing in this work continued during the year. By December the water became undrinkable, owing to growth of masses of algæ and odour-producing micro-organisms in the storage reservoir. The action of the filter-beds was such as to remove them but partially; multiplication continued to take place in the service reservoirs, which, as formerly pointed out, were inappropriately constructed for storage of filtered water. I advised that the Council should be required to so alter the roofing that neither dust nor light should be admitted, and that the zinc-roofing unsuitable in reference to heat conduction should be removed. The Council in remarking on my report before transmission to Government denied the possibility of dust gaining entrance through a space of three inches throughout the length and breadth of the reservoirs, but thought blood-suckers—which are usually considerably larger in this presidency than dust particles—could gain admission. They rejected the light theory, which represents the outcome of the last seven years' labours of various bacteriologists, without argument, and desired that glass shutters should be employed. [The Sanitary Board has, however, since overruled this decision.] The use of a stick and tape by the overseer in charge in lieu of ordinary gauges does not seem, from the result attained by the filter-beds, to have conduced to his ability to control the

rate of filtration, when added to the other peculiarities of this filter-bed mentioned at page 44 of my last year's report.

Dindigul, Tanjore, Trichinopoly.—The water works of Dindigul, Tanjore and Trichinopoly have not been opened sufficiently long to permit of any opinion as to results being given. Up to date, formerly existing sources are largely utilized in all these towns, in addition to the "pipe" water. As in the case of Madura, the two last-named towns are supplied by infiltration from river sub-streams. Seeing that there can be no doubt as to conveyance of cholera by river water in this presidency, in accordance with the warning given at page 44 of my last year's report as to possible influence following the rapidly changing head of filtration, it would be advisable that more be known as to stoppage of the cholera microbe under these special conditions.

The following statistics have been supplied me by Surgeon-Lieutenant-Colonel W. O'Hara, District Medical and Sanitary Officer, Trichinopoly, shewing the influence of water on cholera attacks in that town. It will be seen that the "pipe" water has the advantage, but it is by no means such as ought to be demonstrable. The table, perhaps, is more an excellent statistical statement of how largely the people, instead of using a single supply, really use mixed supplies; but it is enough, I think, to dictate *caution*, as to adoption of this description of infiltration work in the shallow, sandy beds of rivers in this presidency without provision for subjection of the water to the action of ordinary filter-beds after gathering from the gallery. This, however, is a matter that, whilst I consider it necessary to warn concerning, can only be definitely answered by a series of bacteriological experiments :—

Trichinopoly Municipality.

Sources of water for drinking purposes.

Pipe.				Tank.				Channel.				River.				Well.				Unknown.			
Attacks.		Deaths.		Attacks.		Deaths.		Attacks.		Deaths.		Attacks.		Deaths.		Attacks.		Deaths.		Attacks.		Deaths.	
Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
96	114	51	54	152	140	83	66	239	244	136	134	83	93	40	59	10	3	8	2	35	19	33	15
50·00				51·02				55·90				56·25				76·92				88·68			

District boards.

Government, having disposed of the Amended District Municipalities Act, will, it is hoped, shortly be able to give attention to the amendment of the District Boards Act No. V of 1884. Until this is effected, sanitary advance in rural areas must necessarily be saddled with much difficulty. Equally on behalf of localities where fairs and festivals are held, it is hoped, Government will be able to deal with the promised Act on the lines of the Pooree Pilgrim Lodging House Act. Thus correctly equipped with legal power, it should be possible for a very decided advance to be made within a short period. In the meantime, in the absence of power to gather sufficient funds for general purposes, Government has considered it requisite that expenditure under sanitation in common with that under education and medical services should be curtailed, so that a minimum of 50 per cent. of the total land cess collections *plus* the net receipts from tolls of District Boards, shall be available for the better upkeep of communications. The effect of this order seems to me unfortunately to be that education suffers less in proportion to the other services, as the charges being in most part fixed permit of no reduction, whereas those of sanitation are not so and can readily be reduced. In consequence of this order, it is of little use to advise District Boards to employ either permanent sanitary staffs or those intended for combating epidemics, and indeed, the actual efforts made by Local Fund authorities to prevent the spread of the late epidemic of cholera were decidedly inadequate. Under the circumstances, all that can be done is to wait in patience till an improved Act gives the power of obtaining better machinery and more funds to work with in rural areas.

It is necessary for me to enter into the above explanation in reference to the falling off of expenditure under the head of sanitation under District Boards. Thus, against a total allotment of Rs. 6,96,498 for 1895 that for 1896 amounted to only Rs. 6,70,172 or 8·4 per cent. of the total income, against 9·2 per cent. of 1895. Unfortunately, the decrease of expenditure occurred chiefly under improvement of water-supply, as to the necessity for which there is undoubted urgency. Whilst funds have thus been diverted from sanitation, there has also been enforced by Government more judicious expenditure of funds available for conservancy. It was formerly a frequent matter to find that Taluk Boards sanctioned the employment of men in villages for the sweeping of rubbish, who would not remove much more dangerous material in the shape of fæcal matter. Such staffs have now been correctly modified. The tendency for unions to regard the fitting up of lamps as a first call upon their incomes has also been successfully curbed.

Village Sanitary Inspection Report books were in use in all unions in all districts of the presidency at the end of the year except in Vizagapatam, Anantapur and Cuddapah.* Assurances have been received from District Medical officers that arrangements will be completed shortly. In response to requests received from several officers, sample forms embracing all the required information were issued from this office for general adoption.

Personal Proceedings and General Remarks.

Of the total of 365 days, I was absent from head-quarters on inspection duty 210 days. During this period, I travelled 9,784 miles by road, rail and canal. The Deputy Sanitary Commissioner was absent from head-quarters a total of 155 days, and travelled 7,185 miles by road, rail, canal and sea.

Eleven municipalities were formally inspected and reports thereon were furnished by me. Twenty-five towns and villages were also inspected, and with the exception of nine were reported upon.

A number of localities were also inspected and were reported upon by the Deputy Sanitary Commissioner.

A total of 449 places were inspected by District Sanitary officers. Special parts of their reports were pressed on the attention of local authorities where it was found action was unduly delayed.

I should have accomplished the inspection of three more municipalities before the close of the year, but, with the approval of the Government, I undertook a tour in the famine-stricken districts. Before the close of the year, I had inspected certain of the famine works in the Bellary and Adóni taluks. From what I saw of the working of the Famine Code in these taluks and subsequently, I was enabled to advise Government to depart from the arrangements laid down in the Famine Code as to diet and other important particulars.

Towards the end of September, the fact that bubonic plague had appeared in Bombay induced me to issue circulars to all local authorities containing descriptions of the disease, stating the precautions and preventive measures to be taken, and asking that all persons should be warned of the risk they run in going to Bombay. Notices to the latter effect were also posted in all railway stations throughout the Presidency, with the consent of the Railway authorities. In consultation with the District Medical and Sanitary officers concerned, I instituted a system of inspection of passengers at Adóni, Guntakal, Bezwada and Hospet. The names and addresses of all persons proceeding to Madras town were sent on by guards of trains to a Special Inspector of the Municipality of Madras which, in common with all mofussil municipalities, I advised to institute a system of inspection at railway stations followed by domicilliary visits for ten days of all arrivals from suspected or infected areas. All Port officers were warned by me, as, indeed, they had also been in July 1894, of the advance of plague, and they were exhorted to use their powers as to quarantine under G.O., No. 9, Marine, dated 17th January 1890. The necessity for prompt cleansing of municipal towns and the destruction of rubbish and packing materials from the houses of merchants dealing with Bombay was particularly impressed upon municipal councils. Government was advised to sanction a set of rules on the lines of those already in force for combating cholera with suitable alterations in respect to staff and methods. These rules received the approval of Government (G.O., No. 1985 M., dated 18th November 1896), so that should at any time plague appear, each municipality will know what staff and *matériel* to employ in proportion to its

* Up to date no replies to queries have been received from Bellary, Kistna and Gódávari.

population and what action is requisite. These and other measures were ultimately reinforced and enlarged in scope by the direct action of Government armed with powers under the Epidemic Diseases Act of 1897.

Endeavours to control the sanitary care of festivals continue to be satisfactorily recognized by local officials concerned. The great festivals at Tiruvannámalai and Tirupati again passed off without being attended with outbreaks of cholera, all local authorities concerned co-operating cordially in effecting my recommendations. In the case of the latter, there was good reason to regard the arrangements as conducive to this result. A party of pilgrims arrived at Upper Tirupati from Mysore just before the festival, and were attacked with cholera. So far the circumstances of the cholera outbreak in 1893, and those of 1896 were the same; but, in the latter case, there was a sanitary staff already on the spot, in the former case, none had been appointed. Thus the Pushkaram tank—the medium of spread in 1893—escaped infection, as full precautions were at once taken by the staff.

Considerable time was consumed in correspondence with, and in personal visits to, Kumbakónam on the subject of the Mahamagam festival, where a collection of three to five lakhs of persons usually assemble. The Municipal Council, which represents the most highly educated population of Southern India, proved most obstructive and dilatory in effecting recommendations, even where these were of the most obvious and simple character, and, as the sequel told, the festival found them in a state of unpreparedness that operated most adversely. I trust future legislation as to festivals will prevent important sanitary arrangements being subject to undefined standards evolved by local councils as to their necessity.

The movement as to obtaining correctly-instructed Sanitary Inspectors for local authorities inaugurated by Government under my advice in 1894 has progressed successfully. Fifty-two men gained the necessary certificates in 1896. Government has now made it compulsory that at least one trained man shall be entertained in each municipality, and has advised Councils to replace those now in employ by men of the certificated class. As an incentive to this end, men who have had less than five years' service are required to pass the qualifying examination or quit the service. Twenty-eight Councils now possess Certificated Sanitary Inspectors. Four are employed by District Boards, and provision has been made in the budget for 1897–98 for 5 more.

During the epidemic of cholera in the Bellary district, 14 Certificated Sanitary Inspectors were entertained by the District Board, although their services unfortunately were engaged late in the day. One was also employed by the District Board, Gódávari, during the outbreak of cholera following the Pushkaram festival.

Reports of their conduct and professional acquirements received from District Medical and Sanitary officers and from local authorities have been very satisfactory, although there have been a few notable exceptions.

By the end of December, 85 candidates had enrolled their names for the course of training in 1897. Of these, 61 were private students who paid for their course, 31 had passed the Madras University Matriculation examination, one was a B.A., four were F.As., two had undergone the full course for the L.M. & S. of the Madras University, and eight were qualified Hospital Assistants. Many of the matriculates held certificates of efficiency in Surveying, Construction, Estimating, Drawing and other engineering subjects. There is thus room to believe that, if further encouragement be given by local authorities and by Government, a well-educated class of men could be constantly secured as Sanitary Inspectors. It now remains to require that either additional subjects be uniformly passed before entrance to the Hygiene class is allowed, or that this course be prolonged, so as to include them.

Towards the end of the year, the constitution of the Sanitary Board underwent a change by removal of the Sanitary Commissioner and the Sanitary Engineer to Government from the Board, and according to them the position of advisers to the Sanitary Board. This step was apparently the outcome of endless differences of opinion that might naturally be expected to arise where two engineer members were associated with a single sanitarian. As the Sanitary Board will present its own report to Government, and is responsible for advising as to sanitary works, I have not thought it necessary in the body of this report to enter into any details as to proposed improvements. Indeed, I could not do so, as of the ultimate opinion arrived at by the Sanitary Board on schemes presented to its scrutiny, I am under the present system kept in ignorance.

The question of the quantity of water likely to be consumed by municipalities is one open to doubt. There is no town in the Madras Presidency that has been provided with a water-supply that does not adhere to the objectionable arrangement (but in some cases an

arrangement not to be avoided on account of the inadequacy or untrustworthiness of the supply) of maintaining the old sources of supply side by side with the new. The result is that any estimate of what would suffice for a native population founded upon existing sources of information derived from expenditure in public water-supplies, cannot be otherwise than misleading. For example, in Madras, in a native house of a respectable, but not wealthy, class having a public water tap within 10 yards of it, the supply per head was found to be eleven gallons from a well in the premises, and 2·20 gallons from the public supply, on observation carefully conducted and extending over a period of ten days: in another instance where only the public supply was used, the consumption was found to be 14·61 gallons per head—the experiment also extending over ten days. Again, in such water-works as have been formed in the mofussil, the works themselves do not offer the facilities, nor have the municipalities the apparatus, nor at present the wish to largely use the supply for municipal purposes. With the object of throwing some light on this important and strictly sanitary question, I circulated to District Sanitary officers forms asking for measurements of the water supply of households for seven-day periods, under the superintendence of medical subordinates. For facilitating calculations an arithmetical table, and forms setting forth the various domestic purposes to which water is put, were supplied. Altogether, the results of 65 observations extending over the required period were received. The total average shewed that the amount required for domestic consumption under the ordinary conditions of native life was 16·9 gallons per head per day. This represented water drawn in all instances by manual labour and carried over varying distances, and it certainly would result, as experience elsewhere has shewn, that when these difficulties were removed a large increase would be required. Taking, therefore, into consideration the amount necessary for municipal purposes and for "unavoidable waste," and excluding special demands for manufactures and fires, it is probable that 25 gallons would prove a fair supply, and 20 gallons a minimum safe supply for municipal towns. In my humble opinion if water-works in this Presidency are to be trustworthy factors in diminishing the death-rate, they must provide sufficient water for all domestic purposes, and not entail the occasional or habitual use of inferior sources they were intended to supplant. Mechanical arrangements must be provided in anticipation of the period when the advantages of free use for municipal purposes will be fully appreciated; and this may be expected to occur when the facilities offered by sewerage works will induce free consumption under this special head. For this reason, within reasonable limits as to economy, the smaller sizes of pipes should not be introduced into a system to an extent to prohibit the free use of hydrants. Whilst the liberal use of water means health to the individual in private life, it can only be by its equally liberal employment for municipal purposes that a correct sanitary condition re-acting upon the total community can be hoped for. In making these remarks, I, of course, assume, as above suggested, that increased use of water will coincide with provision in towns for its correct removal by sewerage works.

The bacteriological apparatus sanctioned by Government has not yet arrived for use of this office, but is expected shortly. Diagrams and other materials are also expected that will enable advice given to municipal councils to be illustrated during conferences with them before leaving towns that have been inspected.

In accordance with the orders of Government in reference to my suggestion conveyed in the report for 1894, I submitted to Government a simple and inexpensive instrument and a detailed scheme for measurement of sub-soil water fluctuation at chief points throughout the Presidency. The matter is still under consideration.

Sanitary Engineering (1896).

During the year 1896 surveys for water-supply or drainage were completed for seven municipalities, as against three in 1895, irrespective of surveys in progress for one municipality; and additional levels were taken for the water-supply scheme of two municipalities and for the drainage of one. Of the six schemes, costing Rs. 19,85,542, submitted to the Sanitary Board, four—viz., for the water-supply of Srirangam, Kumbakonam, Gudiyattam, and the construction of filter beds and a service reservoir at Cuddapah—were submitted to Government by the Board, and the remaining two schemes for the water-supply of Tuticorin and Bellary were under their consideration; besides these, schemes for the water-supply of Nagapatam and Coonoor, and for the drainage of Cuddapah were under consideration, and revised estimates for five schemes of water-supply, costing Rs. 17,36,569, as against Rs. 15,92,430 (originally estimated) were

prepared. A scheme for supplying the town of Penukonda with water was investigated and the plans and estimates for the work were prepared and submitted to the Sanitary Board. The scheme for the water-supply of Vizagapatam, as revised, was sanctioned for execution by the Public Works Department. Four water-supply works, estimated to cost Rs. 11,32,309 in the aggregate, were under execution ; of these the Trichinopoly and Dindigul works were completed, while fair progress was made with the Kurnool and Conjeeveram works.

The Sanitary Board scrutinised plans and estimates for 72 municipal and 87 local fund works estimated to cost Rs. 2,75,331 in the aggregate. The funds at the disposal of local bodies for sanitary purposes being very limited, the Board found it necessary to approve of a certain number of schemes which, though not in all respects sanitarily perfect, were nevertheless calculated to effect a distinct improvement in the sanitary condition of the areas concerned. Type plans for hospital buildings were prepared by the Consulting Architect to Government in consultation with the Sanitary Commissioner and the Sanitary Engineer and were under the consideration of the Sanitary Board at the end of the year. Type designs for nineteen sanitary works were issued by the Board during the year.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1896.

(*Surgeon Lieutenant-Colonel J. W. Clarkson.*)

General Population.

European and Eurasian Vital Statistics.

By the census of 1891 the European civil population in the Bombay Presidency exclusive of cantonments in quasi-foreign territory, numbers 18,486 persons. During the year 1896, 294 births and 303 deaths were recorded against 358 and 357 in 1895 respectively—a birth-rate of 15·95 per 1,000 against 19·37 in 1895 and a death-rate of 16·44 against 19·31. By sexes 161 males and 133 females were born against 191 and 167 respectively in 1895, and as regards deaths, 188 males and 115 females died against 219 and 138 respectively in 1895.

The Eurasian population numbers 8,519 persons by the census of 1891, and during the year 1896 the births amounted to 156 against 164 in 1895 and the deaths to 195 against 219—the rates respectively of 18·31 per 1,000 against 19·25 in 1895 and 22·89 against 25·71. Of those born 99 were males and 57 females against 94 and 70 respectively in 1895, and as regards deaths 111 males and 84 females died against 113 and 106 respectively in 1895.

A table is appended shewing the European and Eurasian population in each collectorate and the births and deaths for the year 1896 compared with the births and deaths in 1895, and another table following shews the deaths by causes and the ratios in 1896 compared with 1895 :—

Districts.	No.	Collectorates.	Europeans.					Eurasians.				
			Population according to Census of 1891.	Number of Births.		Number of Deaths.		Population according to Census of 1891.	Number of Births.		Number of Deaths.	
				1896.	1895.	1896.	1895.		1896.	1895.	1896.	1895.
Western Registration District.	1	Khándesh	239	7	6	4	3	293	7	2	3	1
	2	Násik	833	9	20	12	17	212	3	5	2	6
	3	Thána	391	1	8	2	4	274	2	2	3	2
	4	City of Bombay ...	10,251	191	201	207	223	4,330	99	112	152	154
	5	Kolába	39	—	1	1	3	2	—	—	—	—
Central Registration District.	6	Ahmednagar ...	332	2	2	1	—	36	1	—	1	—
	7	Poona	1,993	32	71	43	70	948	12	11	20	26
	8	Sholápur	270	17	6	4	5	164	5	8	4	7
	9	Sátára	207	2	4	2	1	60	1	—	2	2
	10	Ratnágiri	46	2	—	—	1	18	—	—	—	—
Southern Registration District.	11	Belgaum	389	2	4	—	2	354	—	2	—	—
	12	Dhárwár	305	11	12	5	5	476	10	6	3	2
	13	Bijápur	42	1	1	—	—	11	—	—	—	—
	14	Kánara	69	1	1	—	1	126	—	—	—	—
Guajrát Registration District.	15	Surat	90	1	1	1	—	75	—	2	—	—
	16	Broach	31	—	—	1	1	9	—	—	—	1
	17	Kaira	41	1	—	1	1	19	—	—	—	—
	18	Panch Maháls ...	19	—	—	—	2	17	—	—	—	—
	19	Ahmedabad ...	388	3	2	7	6	142	1	1	2	1
Sind Registration District.	20	Karáchi	2,077	3	5	4	5	685	10	4	1	2
	21	Hyderabad	129	1	—	1	—	41	—	—	—	—
	22	Thar and Párkar ...	5	—	—	—	—	9	—	—	—	—
	23	Shikárpur	231	7	13	7	7	208	5	9	2	15
	24	Upper Sind Frontier	69	—	—	—	—	10	—	—	—	—
			18,486	294	358	303	357	8,519	156	164	195	219
Cantonments in quasi-foreign territory.	1	Aden...	Not obtainable.	2	1	1	—	Not obtainable.	—	—	—	—
	2	Baroda		—	—	—	—		—	—	—	—
	3	Bhúj		—	—	—	—		—	—	—	—
	4	Deesa		—	3	2	2		1	1	1	2
	5	Mhow		—	—	—	—		3	—	1	—
	6	Nasirabad		—	1	—	1		—	—	—	—
	7	Neemuch		—	—	—	—		—	—	—	—
	8	Rájkot		—	1	—	1		—	—	—	—
	9	Assirghar		—	—	—	—		—	—	—	—
			—	2	6	3	4	—	4	1	2	2

The causes from which deaths among Europeans and Eurasians were recorded are given in the following table :—

Causes of deaths.		EUROPEANS.				EURASIANS.			
		1896.		1895.		1896.		1895.	
		Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.
Bombay Presidency.	Cholera	13	0·71	—	—	5	0·59	2	0·23
	Small-pox... ...	10	0·54	10	0·54	4	0·47	1	0·12
	Fevers	49	2·66	61	3·30	35	4·11	38	4·46
	Dysentery and Diarrhœa.	43	2·33	39	2·11	28	3·28	26	3·05
	Injuries	11	0·60	12	0·65	4	0·47	2	0·23
	Other causes ...	177	9·60	235	12·71	119	13·97	150	17·61
	All Causes ...	303	16·44	357	19·31	195	22·89	219	25·71
Cantonments in quasi-foreign territory.	Fevers	1	*	—	*	1	*	—	*
	Other Causes ...	2	*	4	*	1	*	2	*
	Total —	3	*	4	*	2	*	2	*

* As the population for the Cantonments in quasi-foreign territory is not obtainable, the ratio of deaths cannot be worked out.

Of the 13 deaths registered from cholera among Europeans, eight occurred in the collectorate of Poona, three in Nasik, one in Surat and one in Broach. Of the five deaths from cholera recorded among Eurasians, four took place in the city of Bombay and one in the collectorate of Dhárwár.

NATIVE POPULATION.

Births.—In the Presidency of Bombay, including Sind, during the year 1896, there were 691,847 births registered against 674,304 in 1895. The recorded births for the year under report were thus 17,543 in excess of the number registered in the previous year, and exceeded the mean of the preceding ten years ending 1895 by 50,021. By sexes there were 359,097 males and 332,750 females against 350,115 and 324,189 respectively in 1895.

The following table shews the number of births registered in each year from 1886 to 1896, their ratios per 1,000 of population and the proportion of males to females :—

Years.	Population.	NUMBER OF BIRTHS REGISTERED.			RATIO PER 1,000 OF POPULATION.			IN EVERY 100 BIRTHS THERE WERE		For every 100 male Births the females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1886	16,454,414	303,376	278,177	581,553	18·44	16·90	35·34	52·17	47·83	91·69
1887	16,454,414	327,500	300,693	628,193	19·90	18·27	38·18	52·13	47·87	91·81
1888	16,454,414	330,316	304,377	634,693	20·07	18·50	38·57	52·04	47·96	92·15
1889	16,454,414	312,974	287,515	600,489	19·02	17·47	36·49	52·12	47·88	91·87
1890	16,454,414	333,698	307,417	641,115	20·28	18·68	38·97	52·05	47·95	92·14
1891	18,820,346	354,630	328,017	682,677	18·84	17·43	36·27	51·95	48·05	92·50
1892	18,820,346	337,150	313,517	650,667	17·91	16·66	34·57	51·82	48·18	92·99
1893	18,820,346	345,424	318,881	664,305	8·35	16·94	35·30	52·00	48·00	92·32
1894	18,820,346	342,911	317,357	660,268	18·22	16·86	35·08	51·94	48·06	92·55
1895	18,820,346	350,115	324,189	674,304	18·60	17·23	35·83	51·92	40·08	92·59
Mean for 10 yrs.	17,637,380	333,809	308,017	641,826	18·93	17·46	36·39	52·01	47·99	92·27
1896	18,820,346	359,097	332,750	691,847	19·08	17·68	36·76	51·90	48·10	92·66

The recorded birth-rate for the year was 36·76 per 1,000 of population against 35·83 in 1895 and a mean of 36·39 for the previous ten years.

Of the 24 collectorates and districts the number of recorded births in 1896 was higher than in 1895 in 16, viz.:—

Khándesh.	Ratnágiri.	Panch Mahals.
Násik.	Kánara.	Ahmedabad.
Thána.	Surat.	Karáchi.
City of Bombay.	Broach.	Shikárpur.
Kolába.	Kaira.	Upper Sind Frontier.
Poona.		

The remaining 8 collectorates and districts shew a decrease as compared with 1895. There appears some improvement in the registration of births in Sind, especially in the collectorates of Karáchi and Shikárpur and in the district of Upper Sind Frontier. In the collectorate of Hyderabad and in the district of Thar and Párkar the registration of births is apparently defective. The city of Bombay shews slight improvement in the registration of births over last year. The recorded birth-rate per 1,000 of population for the city of Bombay was 19·35 against 19·07 in 1895, and the mean for the last ten years ending 1895 was 19·29.

As regards the comparative low birth-rate in the collectorates of Belgaum, Dharwar and Bijápur, the Deputy Sanitary Commissioner, Southern Registration District, states: "The "decrease in the number of births recorded in Belgaum, Dhárwár and Bijápur may be chiefly "ascribed to the failure of the crops throughout Bijápur, whilst in Dhárwár and Belgaum a "large number of villages in the eastern tálukas were seriously affected. Under these "circumstances, owing to the movement of many of the villagers to the Mulad with cattle "and of others to distant places in search of work, it is but natural that the birth-rate "should suffer. Many births must in consequence have escaped registration."

As regards the decrease in the number of births recorded in the collectorate of Hyderabad and the Thar and Párkar District, the Deputy Sanitary Commissioner, Sind Registration District, remarks that "the alleged causes of decrease being the absence of rain and "consequent scarcity of fodder in the latter, and the prevalence of fever in the former."

The recorded birth-rates among the urban and rural populations of the Presidency were 29·61 and 37·76 against 29·04 and 36·78 in 1895. Except in the collectorates of Ratnágiri, Dhárwár, Kaira, and throughout Sind, except in the Upper Sind Frontier, the birth-rates were higher among the rural than in the urban population.

Out of 56 towns in the Presidency, 16 had a birth-rate exceeding 40 per 1,000. Thána, Násik and Bombay have still very low birth-rates.

Deaths.—Among the civil population in the rural, town and cantonment circles in the Presidency 596,472 deaths were registered during the year 1896. In 1895, 538,540 deaths or 57,932 less than in 1896 were recorded.

The following statement shews the number of deaths recorded in each year since 1886 :—

1886	... ...	381,185	1890	... ...	463,616	1894	... ...	607,179
1887	... ...	455,261	1891	... ..	513,132	1895	... ...	538,540
1888	... ...	468,039	1892	... ...	611,742	1896	... ...	596,472
1889	... ...	518,562	1893	... ...	511,831			

Of the total deaths registered 312,458 occurred among males and 284,014 among females, against 280,866 and 257,674, respectively, in 1895.

The computed death-rate per 1,000 of population in 1896 was 31·39 against 28·61 in 1895 and a decennial mean of 28·74. The millesimal rates of males dying to males living was 32·09, and of females dying to females living 31·27. In 1895 these ratios were respectively 28·84 and 28·37. For every 100 females who died 110·01 deaths among males were recorded, but these proportions vary considerably in the following collectorates :—

In Khándesh	the ratio of male to female deaths was		112·42	per cent.
„ Bombay	do.	do.	120·97	„
„ Ahmednagar	do.	do.	111·31	„
„ Kaira	do.	do.	119·41	„
„ Panch Mahals	do.	do.	113·45	„
„ Ahmedabad	do.	do.	112·08	„
„ Karáchi	do.	do.	119·54	„
„ Hyderabad	do.	do.	127·87	„
„ Thar and Párkar	do.	do.	122·98	„
„ Shikárpur	do.	do.	119·37	„
„ Upper Sind Frontier	do.	do.	119·64	„

The recorded death-rates per 1,000 of population were higher than in 1895 in all the collectorates and districts, except in the collectorates of Ahmednagar, Sholápur, and

Sátára. The recorded death-rate per 1,000 of population in 1896 was higner than the annual mean of the preceding ten years in the following collectorates and districts :—

Khándesh.	Poona.	Kaira.
Násik.	Sátára.	Panch Máhals.
Thána.	Ratnágiri.	Karáchi.
City of Bombay.	Belgaum.	Thar and Párkar.
Kolába.	Bijápur.	Upper Sind Frontier.
Ahmednagar.	Surat.	

In the collectorates of Broach, Ahmedabad and Shikárpur the recorded death-rate for 1896 was about equal to the annual mean for the preceding 10 years. In the collectorates of Sholápur, Dhárwár, Kánara and Hyderabad, the recorded death-rate for 1896 was lower than the annual mean for the preceding 10 years ending 1895.

Deaths by ages.—The mortality amongst children under 5 years of age is high and amounts to 40·49 per cent. of the total deaths, and the infantile mortality under one year is 179·38 per 1,000 living. Under one year the percentage on total deaths was 20·46 against 22·30 in 1895, and in the age period 1 to 5 years the percentage was 20·03 against 21·13 in 1895. The period of greatest immunity was, as last year, in the age period of above ten and under fifteen, the rate being 10·16 living or 3·10 per cent. on total deaths. Among old people of 60 and upwards, the percentage on total deaths was 13·57 against 14·81 in 1895.

Deaths by caste or class.—According to the Census of 1891, the Mahomedan population numbered 3,501,910 persons, amongst whom in 1896, 85,746 deaths were recorded against 71,965 in 1895, the death-rate being 24·48 per 1,000 of population against 20·55 in 1895. The Hindu population amounted to 14,897,629 persons, amongst whom 502,590 deaths or 33·74 per 1,000 of population were recorded. In 1895 the total deaths amongst this race were 459,918, equal to a death-rate of 30·87 per 1,000 of population. Amongst the Christian population, numbering 122,089 persons, 3,016 deaths were reported during the year against 2,509 in 1895, the death-rate being 24·70 against 20·55 in 1895. Under the heading "Other Castes" are included all those not belonging to either of the above sects, who, by the census of 1891, numbered 298,718 persons, amongst whom, during 1896, there were 5,120 deaths against 4,148 in 1895, the death-rate being 17·14 per 1,000 of population against 13·88 in 1895. Among Mahomedans the maximum death-rate during the year (53·08 per 1,000) took place in the city of Bombay, and the minimum (16·04) in Hyderabad. In 1895 the maximum death-rate was 48·84 in Násik and the minimum 13·10 in Hyderabad. Among Hindus the maximum death-rate (44·77 per 1,000) was in the collectorate of Násik and the minimum (23·53) in the Thar and Párkar District. In 1895 these rates were Sholápur (40·22) and Thar and Párkar (17·46) respectively.

As regards the disproportion in the death-rates of Mahomedans and Hindus in Sind, the Deputy Sanitary Commissioner, Sind Registration District, refers to his remarks made last year and considers that the discrepancy is due to defective registration in the rural circles, it being there in its earliest infancy and in the hands of tappedárs and village pátils and mukhis over whom it is difficult to exercise supervision as regards death-rates.

Deaths by causes.—The subjoined table shews the deaths in 1896, arranged according to the specified causes laid down by the Government of India, and contrasts with the results for 1895, and the mean of the preceding ten years. The causes of death will be briefly noticed in the next section :—

Causes of deaths.	Mean for 10 years, 1886–1895.		1895.		1896.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	22,008	1·26	8,890	0·47	35,404	1·88
Small-pox	3,153	0·18	2,299	0·12	6,443	0·34
Fevers	357,247	20·25	388,848	20·66	412,229	21·90
Dysentery and diarrhœa ...	38,504	2·18	35,348	1·88	36,046	1·92
Injuries	5,840	0·33	6,051	0·32	6,238	0·33
Other causes	80,156	4·55	97,104	5·16	100,112	5·32
All causes	506,908	28·74	538,540	28·61	596,472	31·69

Chief Diseases.

During 1896 cholera caused 35,404 deaths throughout the Presidency, while in the preceding year, 8,890 deaths were registered from this disease. The epidemic prevailed chiefly in the Poona, Bijápur, Sátára, Belgaum, Ahmednagar and Dhárwár Collectorates. Cholera.

In December 1895, deaths from cholera were reported from fourteen collectorates. Of these collectorates cholera was reported in Násik, Kolába and Ratnágiri on the 1st January, in Bijápur, Poona and Thána on the 2nd January, in a town of Ahmedabad on 7th (only one death), Sàtára Collectorate on 10th and Bombay City on 17th, practically a continuation from the previous year. Khándesh, Ahmednagar, Sholápur, Belgaum and Kaira Collectorates returned no cholera deaths for the month of January. The other collectorates were free from cholera at the end of last year. The cholera in Thána, Sátára, Bijápur and Ahmedabad, however, stopped during the month and no cases were reported during February, but continued in Násik, Kolába, Poona and Ratnágiri Collectorates and Bombay City. In March, however, in addition to the above, the collectorates of Khándesh and Ahmednagar were affected and the disease appeared again in Thána and Bijápur. In April cholera was first reported for the year in the districts of Dhráwár and Surat and re-appeared in the Ahmedabad Collectorate, besides continuing in the districts affected in March and a much increased mortality took place.

In May the outbreak continued in the above collectorates and in addition the appearance of the disease for the first time during the year was reported in Sholápur, Belgaum, Broach, Kaira and the Panch Maháls, and the mortality was double that of the previous month. In June, 5 deaths were reported from the Thar and Párkar District of Sind, but with this exception no other death from this cause took place in Sind during the year. The whole of the rest of the Presidency was affected during this month and continued to be so during the months of July and August, the mortality reaching the highest point in July and declining somewhat in August. In September, though all the districts except Ahmedabad returned cholera deaths, there was a large decrease in the mortality; still further decrease occurred in October, and in December the total deaths recorded were 911 from 9 districts only.

By seasons, 23,501 deaths occurred in the rainy season of 122 days, and 8,850 in the hot and dry season of 61 days.

Out of the 21,608 villages in the districts affected by cholera, 2,642 or 12·23 per cent. were attacked during the year. The highest percentage took place in the Bijápur Collectorate, where out of the 1,110 total villages 466 or 41·98 per cent. were affected. In Poona, out of 1,187 total villages, the disease appeared in 357 or 30·08 per cent. In Belgaum, Sátára, Ahmednagar, Sholápur, Surat, Broach, Dhárwár and Ahmedabad the percentages were respectively 22·67, 21·22, 15·99, 12·90, 12·20, 11·66, 10·85 and 10·56; whilst in the remaining 9 collectorates the percentages were below 9.

During 1896 there were 6,443 deaths from small-pox (3;417 males and 3,026 females) against 2,229 in 1895 and a decennial mean of 3,153.

In every district and in all the collectorates excepting four, viz., Kolaba, Sholapur, Bijápur and Kánara, the number of small-pox deaths has increased during the year. In the Western Registration District, the disease attained a ratio of 0·65 per 1,000 against 0·30 in 1895 and a decennial mean of 0·34. In the Gujarat Registration District the ratio was 0·48 against 0·05 in the previous year and a decennial mean of 0·06. In the Sind Registration District it was 0·31 against 0·07 in the previous year and a decennial mean of 0·15. In the Southern and Central Registration Districts the ratios per 1,000 of population were respectively 0·19 and 0·09 against 0·06 and 0·08 in the previous year, and 0·17 and 0·13 the decennial mean. In the collectorates the highest death ratio 0·94 took place in the Khándesh Collectorate and the lowest 0·01 in two collectorates of Sholápur and Bijápur. The Presidency rate was 0·34 against 0·12 in the previous year and 0·18 the decennial mean. Small-pox.

According to age, 29·50 per cent. of the small-pox deaths occurred amongst infants under one year of age, whilst 51·78 per cent. took place among children over one and under 12, the remaining 18·72 per cent. being among persons over 12 years of age.

During 1896, 215,723 males and 196,506 females, or a total of 412,229 persons, were reported to have died from fever against 388,848 in 1895, shewing an increase of 23,381 deaths for the year, the mean for the previous ten years being 357,247. Fever.

In the Gujarát Registration District fever caused a high mortality, 29·42 per 1,000 during the year against 22·68 in 1895 and the decennial mean 27·75. In the Western Registration District the death ratio was 24·08 against 21·49 in the previous year and 19·69 the ten years' mean. In the Central Registration District the ratio for the year was

21·40 against 24·45 in the previous year and 19·81 the decennial mean. In the Sind and Southern Registration Districts the respective ratios for the year were 19·34 and 14·87 against 15·81 and 16·07 in the previous year and 17·77 and 16·56 the ten years' mean. The Collectorate of Broach heads the list with the high ratio of 33·23 against 23·85 in 1895 and 32·81 in the previous ten years ; and the lowest ratio 10·95 was attained in the town and island of Bombay and 13·72 in the Belgaum Collectorate, the Presidency rate being 21·90 against 20·66 in the previous year and 20·25 the decennial mean.

The number of deaths from fever and the death-rate per 1,000 of population though less in the famine districts of Ahmednagar, Poona, Sholápur, Sátára in the Central Registration District and Belgaum and Bijápur in the Southern Registration District, was higher in every other district than the last year. When compared with the previous year the increase amounts to 23,381 deaths in the total number of the Presidency. Taken by registration districts, Western, Gujarat and Sind Districts shew increased mortality. For this increase the Deputy Sanitary Commissioner, Gujarát Registration District, observes as follows :— "The years 1892, 1893 and 1894 were years of more than average rainfall and shew a "high death-rate from fever, whereas 1895, with a rainfall below the average, shews a large "decrease in fever mortality." It might, therefore, naturally be supposed that the effects of the dry year would be felt in the first half of the following year, and when this year 1896 also passed with a rainfall still more scanty than its predecessor, the effect on the fever mortality should have been still more marked. According to the returns there is an increase in fever mortality in all the collectorates, resulting in a total increase for the district of 20,876. This increase is most marked in the first nine months of the year, the largest addition being in the months of June, July and August, whereas for the last three months of the year, the recognized months of malaria, the increase is least. These apparently contradictory figures admit of explanation to some extent. The returns for the last three months of both years 1895 and 1896 shew comparatively little difference, and these are the months during which it is generally recognized that malarial fever is most prevalent. During the first nine months of the year small-pox and cholera were prevalent in an epidemic form throughout the district, and it is possible that many deaths due to one or other of these diseases were entered as deaths from fever. Moreover, there are many villages in which every death is returned as due to fever and consequently in such villages a large proportion of deaths must be wrongly entered. It is worthy of note that during the last three months of the year, when malarial fever is most prevalent, the returns for the two years—1895 and 1896—correspond fairly accurately, while the large divergence occurs in the latter part of the cold weather when deaths from chest affections are most liable to occur and in the hot weather and first months of the monsoon when epidemic diseases are most prevalent. Additional evidence in favour of this explanation is offered by the following figures which shew the returns from fever during the last three months of the five years from 1892 to 1896 :—

Year.	Deaths from fever during October, November and December.
1896	... 19,026
1895	... 18,703
1894	... 27,396
1893	... 25,879
1892	... 39,448

"The years 1892, 1893 and 1894 were years of more than average rainfall, and we see the "effects in the large increase in fever mortality during the last quarter of the year. In "1895 and 1896 the rainfall was scanty and a consequent diminution in deaths from fever "during the same months. Therefore, I think, it is not possible to accept the returns of "deaths from fever during 1896 as representing the mortality from malarial fevers."

In the first seven months from January to July the deaths from fever were above the corresponding months of 1895 and the ten years' mean. In August they are only less by two than 1895, but they are above the mean by 5,413. In September they are less by 3,938 than 1895, but they are above the mean by 158. During the months of October, November and December they are both below the 1895 and the mean figures. It will be noted that the fever mortality which began to rise in December 1895 continued to increase in January 1896 (the maximum for the year) and continued at a high level till March, when a decrease is shewn ; the lowest fever mortality appears, as usual, in June. In July and August, the period of heaviest rainfall, a rise is observed, but in September, when the rains failed, a decline takes place.

In accordance with the desire of the Army Sanitary Commission a slight meteorological sketch for the year is here appended.

For the first four months of the year there was practically no rain, a higher maximum temperature is shown, and the range of the temperature is also higher than last year. In May a few showers occur, with the effect of slightly lowering the temperature and diminishing the range. Throughout the Presidency the rains began early in June and, in the districts of Násik, Ahmednagar, Poona, Sátára, Belgaum and Dhárwár, the fall was above the average. In Khándesh and Sholápur it was about the average, in Bijápur and the northern parts of Surat below it. In the month of July the rainfall, except in Sholápur and Bijápur where it was insufficient, was far above the average and in some districts excessive. In the early part of August also rain fell during the first part of the month, being above the average in Poona, Belgaum, Dhárwár and the southern parts of Surat, but towards the end of the month the rain stopped, and the rainfall in September and October throughout the districts was very slight and deficient. In the month of November 6 inches and 76 cents. fell in four days in Sholápur, and in Bijápur there were the usual showers. The maximum temperature diminished with the rainfall and also did the range, but increased again as the rain ceased in August. The price of food-grains also very seriously increased ; wheat which was selling in January from $18\frac{10}{16}$ to $12\frac{15}{16}$ seers sold in December from $9\frac{5}{16}$ to $6\frac{15}{16}$ seers per rupee. Second sort rice, which varied from $12\frac{9}{16}$ to $8\frac{5}{16}$ seers in different districts, rose to 10 to $6\frac{1}{2}$ seers. Jowári which sold from 28 to $18\frac{1}{2}$ seers rose to $12\frac{1}{8}$ to $9\frac{3}{8}$ seers a rupee, and bajri, which varied from $23\frac{1}{4}$ to $14\frac{3}{16}$ seers for a rupee in different districts in January, rose to $8\frac{15}{16}$ and $9\frac{1}{4}$ seers in the same districts.

Plague.

First Appearance of Plague in the City of Bombay.—On the 29th September 1896, a committee, consisting chiefly of medical men, assembled in Bombay by order of Government, declared plague to exist in Bombay. The existence of this disease had been notified about a week previous by Dr. Viegas, a local practitioner, and Dr. Surveyor working with him had isolated a bacillus resembling that of plague as discovered by Dr. Kitasato of Japan, and this was confirmed later by Surgeon-Captain Childe, M.B., Professor of Pathology in the Grant Medical College.

How the disease was brought into Bombay cannot be ascertained. Various theories have been brought forward, that it was brought in by rats, of which large numbers of dead ones were observed, by the grain supply, by sewers which had become infected. I do not propose to discuss all these theories, which will be argued out in time and supported or otherwise by the investigation of the scientific Plague Research Committee now at work in Bombay. I see no reason why the disease should not have been introduced into Bombay by the usual agency of human intercourse. No one suspected the disease, nor did the weekly death returns shew anything very abnormal almost up to the date of the discovery of the existence of plague. There is no reason why a case coming from an infected locality, say on board ship, for instance, may not spread the disease to fellow passengers, and these infected land without notice. Once the infection was introduced, and had time to establish itself, there is every facility for its propagation as large numbers overcrowd into badly ventilated rooms, and not only this but the ground itself being damp and the soil very contaminated, the vitality of the inhabitants is lowered by their bad environment and perhaps still further impoverished by insufficient or innutritious food. That the disease is chiefly communicated from one person to another is, I think, clear. That it may be conveyed by air from one person to another is still open to doubt, but that the poison is in the discharges of the sick there is no doubt, and the casual way in which these are removed or left on clothing is one of the chief causes of propagation among a population overcrowding into badly ventilated dwellings. The year's weekly mortality for the city as compared with corresponding weeks of the previous year shews, with three exceptions, an increase which becomes marked in March and continues so to the end of April, and then a drop below last year's figures almost to the end of June. Then, again, the mortality commences to exceed that of the previous year, shewing a marked rise at the end of August with a drop in the succeeding two weeks, resembling what occurred in the April previous, but after that the mortality again rose and Dr. Viegas states that he saw his first plague case on 18th September. After which other medical men also recognized the disease which was declared to exist on the 29th of the month. Compared with the mean of the previous five years the average weekly mortality of the present year exceeded the mean to the end of April. During May and almost to the end of June the average weekly mortality

was about the same as the five-year mean, being less in three instances and being exactly the same as the mean for the week ending 19th May. From the end of June began the gradual rise which soon far exceeded the mean. The rise in the weekly mortality shewn to have occurred in the early part of the year (6 weeks—March–April) was most marked on the 2nd Nágpáda, Kámáthipura and Tárdeo divisions.

In the rise, which took place later, for the week ending 30th June the highest mortality reported took place in the *worli* division, and it was the same the following week, but afterwards 2nd Nágpáda and Kámáthipura shewed, as a rule, the highest average mortality, but there is nothing to shew that any special agency was at work. Both these districts have shewn a high mortality for some years past, and the Health Officer has drawn repeated attention to their sanitary defects. In looking over the weekly death returns by districts there is nothing to indicate that any special outbreak was about to take place. Turning to Mándvi, which has for years past shewn a high death-rate from fever, there is nothing in the weekly returns to shew cause for alarm till the week ending 28th July, when the total mortality was 39 (or an average annual rate of 54·37 per 1,000) and of these 8 were ascribed to fever, but next week the total mortality falls. For the week ending 25th August, however, there is an increase in the fever death and total mortality, and this continues for the next two weeks, followed by a slight decrease in the next week, but for the week ending 22nd September there is a very serious increase from fever and in the total mortality, and the existence of plague was diagnosed and confirmed shortly after. It appears that the poison when first introduced into a place spreads slowly ; but after a careful perusal of the figures supplied I am unable to state in what division the disease originated, or at what time, and it is quite possible it may have been in more than one division, but gathered strength and developed itself first in Mándvi. It is doubtful if meteorological conditions affect the incidence and spread of plague. As regards meteorological conditions in Bombay, Surgeon Lieutenant-Colonel Weir, the Health Officer, states that the mean annual temperature of the year was 80·7, the second highest on record for the past 51 years. The total fall of rain amounted to 87·6 inches, being 15 inches above the average, but the distribution of the rainfall was abnormal. " The rainfall in June was 28 inches, or 8 inches above the average, and in July the rain- " fall amounted to 36·4 inches, or 11·7 inches over the average. In August the rainfall " amounted to 20·8 inches, giving an excess of 7½ inches over the average. In September " only 1·6 inches of rain fell, being 10 inches lower than the average. This is the most " abnormal month of an abnormal year yet recorded (even in the famine years of 1876-77 " the September rainfall was not less than 4 inches), and an abnormal September was " followed by an abnormal October, dry and warm."

Ahmedabad.—Soon after plague was declared in Bombay the people began to leave for non-infected districts. The mofussil municipalities having been warned, those upon the line of rail did what was possible to keep out the disease by instituting a medical inspection of passengers arriving from Bombay, and this was attended with some measure of success ; but owing, however, to lack of legal compulsory powers, the infection could not long be kept out. The first imported case was at Ahmedabad. A Musalman working in Mándvi Bandar gave a history of fever with slight glandular enlargement beginning on 18th September, 1896. He left for Ahmedabad, arriving 25th September, and lived in the Makeriwád lane, and was under the treatment of a local practitioner for eight days, till on 3rd October he was seen by Assistant-Surgeon Gándhi, and next day by the Health Officer as well, who both considered and treated it as a plague case. The Civil Surgeon also saw the case. No connection could be traced between this and the next two cases. The patient survived. The second case was that of a Márvádi who was a loader and cart-driver working on the Ahmedabad Railway Station goods yard. He had not been away. He left work on 28th September on account of fever, was seen by Dr. Gándhi on 3rd October, and died the same day. He was acquainted with No. 3. The third case occurred in a Bania clerk, who was formerly in the service of the same master as No. 2. He had been to Wadhwan, returned on 17th September, loitered about the railway station goods yard till 24th, searching for employment. Got employment on the 26th September. Taken to Assistant-Surgeon Gandhi's dispensary on 3rd October, died on 5th. He was acquainted with No. 2. The Health Officer, Ahmedabad City, made the most careful enquiry but failed to trace any connection between the first and the next two cases, and was inclined to ascribe it to handling infected grain or goods from Bombay, but up to the close of the year no other local cases were detected. The measures recommended to the Collector were the inspection at the railway station and removal of those affected to an isolated hospital. Those healthy to be allowed to depart after disinfection, and after taking their names and addresses. In the town in the case of chawls and tenement houses,

removal of the sick was recommended, and the thorough and efficient cleaning not only of the infected room but of the whole house, the burning of infected bedding used and all rags and rubbish, and the opening up of the whole place to fresh air. The Municipality in consultation with Surgeon-Lieut.-Colonel Bartholomeusz, the Civil Surgeon, and Mr. Gibb, the Collector, engaged a staff to examine passengers from Bombay and remove the sick to the isolation hospital ; the goods in the yard were disinfected, and also what had been lately carted away, wherever possible, and arrangements made with the railway authorities to disinfect as far as possible goods and passengers' luggage at the railway station. The city was also cleaned. The houses of patients 1 and 3 were disinfected, and that of No. 2, being a hut, was burnt. After this 9 cases were detected at the railway station in October, none in November, and 38 in December, but no more local cases occurred up to the close of the year. Out of the total of 50 cases 26 deaths were reported.

Poona.—The next place from which imported cases were reported was Poona, on the 2nd October. Since 30th September two medical men with four assistants had been posted at the railway station by the Municipal authorities. Mr. Plunket, C.I.E., the Chairman of the Poona Suburban Municipality, making the arrangements and looking to the sanitary condition of the suburban limits and the prevention of overcrowding. During October four cases were detected, in November one case, and in December 43 cases. Four cases were also detected in the city and one in the cantonment. In all, 53 cases and 39 deaths were reported to the end of the year, all cases being imported. The cases were at first sent to a shed in the compound of the Sassoon Hospital, which is in the limits of the Poona Suburban Municipality, but as more accommodation was required a regular camp hospital was laid out in an open space near the hospital in December, and the cases treated there. There was a great deal of difficulty in persuading relations to allow of the sick being taken to the isolation hospital, as there was no compulsory law at the time, and in some instances the sick were taken away.

Thána, Kalyán, Dhulia, and Bándra.—After appearing in Poona, a single case of plague was detected in Thána town, 20 miles from Bombay, on the line of rail, on the 8th October, and on the same date in Kalyán town, ten miles further on, and seven days later on in Dhulia town in Khándesh. On the 26th October it was first reported in Bándra, which is really a suburb of Bombay—a town on the north-west exit from the city. Isolation and other measures were advised, but the Municipality moved slowly, and the people themselves opposed all measures of removal, and so the plague progressed. Bándra being a place noted for the number of pigs allowed to wander freely about, a caution was sent that, if any cases of sickness occurred amongst pigs, all straying were to be driven outside the town and destroyed, but information was later received that there was no cause for alarm as regards pigs, as they continued healthy. It has been stated that pigs do suffer from a disease similar to plague, but no observations made in this country have as yet come to hand.

Surgeon-Major Anderson, the Deputy Sanitary Commissioner, Western Registration District, writes that the first two important cases did not appear or spread the disease, as when it became local the parts of the town affected were not those in which these two died. The first case reported was that of a Mhár who came from Bombay on the 26th October, and the second case occurred on 24th November. Then on 3rd December it appeared in two different parts of the town ; in one case (the third) six cases occurred in the house at intervals, and dead rats had been found a week previously to the first case, and in the second case two deaths occurred, but no dead rats found. The fifth case was at a distance from the third case, but had been employed there, and in his house also dead rats were found. Subsequently the disease developed around the house of No. 3 and spread.

Escape of Kurla from the plague.—Kurla, which is situated on the north-east exit from Bombay, escaped local infection up to the end of the year.

A table is appended shewing the progress of the disease in the mofussil, but the figures shewing the attacks and deaths must not be accepted as correct, as there is little doubt that there was a great deal of concealment of cases, and many plague deaths were entered under other heads.

Karáchi.—In Sind, Karáchi was the first place affected, and the first case was reported on the 10th December, but though Surgeon-Captain Arnim, D.P.H., the Deputy Sanitary Commissioner, Sind Registration District, who was in Karáchi at the time, instituted minute and careful enquiries regarding the origin of the first two cases brought to notice, his enquiries failed entirely to trace the disease to any source outside Karáchi. Karáchi defended itself against Bombay by quarantine rules, but in spite of this there can be little doubt that the infection was imported from Bombay. The municipality were advised to

put in force the usual measures of isolation and removal of the sick and the removal of the healthy from infected houses to camps, the cleansing and opening up of the infected houses to light and air, and were also recommended to divide up the infected area into such sub-divisions as could easily be supervised, and to offer a fee for notification. The Municipality acted with promptitude, the Deputy Sanitary Commissioner, Sind Registration District, reporting that "the Municipality are taking matters in hand in a way that reflects great "credit on them," and issued a set of rules in the spirit of the above recommendations, but unfortunately the compulsory powers of segregation were not at once granted. By the close of the year 63 cases with 59 deaths had been reported, but this does not represent the real amount of the disease as great concealment was practised.

The first sanitary point in connexion with plague is to prevent its introduction into a place. When it comes in unsuspected, as it did into Bombay, the only measures are to take precautions that no further importation of infected persons and their belongings are allowed, and to try and localize the outbreak, which can be done, I think, if set about in a vigorous way and early. When, however, it is known to exist in a place, what are the measures to be taken by persons and places free from the disease? It is quite clear that without very autocratic powers not much good can be done in India to keep it out. The first thing then for a town desiring to protect itself is to obtain powers and to examine all people arriving. Those clearly sick are, of course, to be sent to an isolation hospital, but the difficulty arises in the case of those not sick, but who have come from an infected locality. In England, of course, disinfection takes place, the names and addresses are taken, and the local medical officers of health informed; if going beyond the particular town the medical officer of health of the locality is informed by telegraph. There are a number of reliable medical officers of health with comparatively small areas to keep watch over the people introduced into the locality, but in India where there is not a medical health officer for 10,000 square miles, and where if names and addresses are taken, they are by no means to be relied on, the problem is very difficult. In the case of large towns, I am in favour of camps of observation. All persons not sick, but coming or suspected to come from an infected area, should be put under observation for ten days. The persons and clothes disinfected, both on arrival and departure from camp.

In the case of persons well known to the town and not passing through, this rule might be relaxed, they and their servants might be passed, the master being held responsible for the servants, or they might be sent for inspection daily.

In villages and small towns such measures cannot be enforced, but the inhabitants themselves might prevent strangers from entering, and keep them outside the village for a ten days' period. Even if cases escaped observation such measures as indicated would prevent or greatly lessen the enormous rush of people from an infected locality and lessen the chance of spread to non-infected areas.

When the plague has seized hold of a town the only way is to divide it up into convenient areas and go through the place thoroughly by house-to-house inspection, constantly repeated without warning, for in spite of every inducement concealment of cases to a large extent will, in India, always occur. Every death also not certified by the medical officer should be treated as suspicious and the place of death inspected and disinfected.

Every one sick of the disease should be moved to an isolation hospital. The sick person is the centre of infection through the discharges. He cannot be kept isolated from friends, and when death occurs a large number of friends and relations crowd in to mourn and perform the funeral ceremonies. All this can, to a great extent, be prevented if the patient is sent to a properly equipped isolation hospital, as in case of death only the necessary relatives come to perform the last rites and the body is handed over after being disinfected. Also the other dwellers in the affected room and if necessary all in the house should be moved and the whole place thoroughly disinfected and the inhabitants not allowed to return for ten days.

Air, light and cleanliness appear to have a great effect on the disease. As far as I could gather up to the close of the year no medical men or the attendants on the sick in plague hospitals have been attacked by the disease, and this is due to the wards being well lighted and ventilated, and cleanliness insisted upon, both general and personal.

No discussion upon questions relating to importation of plague by grain, wool, hides, and other articles of commerce is entered upon, as I understand all these matters are under investigation by a Scientific Plague Research Committee now at work in Bombay.

As to how far rats are the agents by which plague is imported into a place from another at some distance is a matter difficult to decide, but that in an infected place they do carry the infection, I think there will be evidence. Many cases have been noted, especially in servants' quarters, in which were rat holes, and after dead rats had been found, though

the inmates were moved out, yet plague occurred among them ; but it is well to withhold decided opinion until the mass of evidence collecting is completed, which will give information on many important points.

As a result of this outbreak, however, more attention will be directed to sanitary measures in large towns in the way of better building laws, to try and lessen the overcrowding on space, and the regulation of water-supply and drainage.

Statement shewing the progress of Plague.

Name of			Attacks.			Deaths.	Date of first appearance.
District.	Táluka.	Town or Village.	Imported.	Local.	Total.		
——	——	Bombay	—	2,541	2,541	1,803	September.
Ahmedabad ...	Daskrohi ...	Ahmedabad ...	48	2	50	26	25th September.
Poona ...	Haveli ...	Poona Suburban...	48	—	48	34	2nd October.
Thána ...	Salsette ...	Thána	1	—	1	1	8th do.
Do. ...	Kalyán ...	Kalyán	1	—	1	1	Do.
Khándesh ...	Dhulia ...	Dhulia	1	—	1	1	15th do.
Thána ...	Salsette ...	Bándra	4	98	102	70	26th do.
Kolába ...	Mahád ...	Wahur	1	1	2	1	29th do.
Khándesh ...	Bhusával ...	Kandari	5	—	5	4	1st November.
Poona ...	Haveli ...	Poona Cantonment	1	—	1	1	12th do.
Ahmedabad ...	Gogo ...	Tansa	1	—	1	1	17th do.
Do. ...	Do.	Kuda	1	—	1	—	Do.
Do. ...	Do.	Gogo	2	—	2	2	Do.
Surat ...	Bulsár ...	Bulsár	2	—	2	2	21st do.
Kolába ...	Nágotna ...	Nágotna	3	—	3	3	26th do.
Thána ...	Umbargaon ...	Máraoli	1	—	1	1	29th do.
Do.	Sálsette ...	Kurla	5	—	5	4	2nd December.
Do.	Umbargaon ...	Umbargaon ...	1	—	1	1	3rd do.
Do.	Do. ...	Narayangol ...	1	—	1	1	5th do.
Surat ...	Jalálpur ...	Khursad	7	—	7	7	6th do.
Do.	Do. ...	Abruna	3	—	3	3	Do.
Do.	Surat ...	Surat	6	—	6	4	8th do.
Broach ...	Kapadvanj ...	Kapadvanj ...	6	—	6	5	10th do.
Karáchi ...	Karáchi ...	Karáchi	—	63	63	59	Do.
Thána ...	Bhiwandi ...	Bhiwandi	2	9	11	10	12th do.
Ahmednagar	Nagar ...	Ahmednagar ...	6	—	6	4	Do.
Sholápur ...	Sholápur ...	Sholápur	1	—	1	1	17th do.
Do. ...	Pandharpur ...	Pandharpur ...	1	—	1	1	Do.
Broach ...	Broach ...	Broach	5	—	5	5	Do.
Kolába ...	Roha	Sadsai	1	—	1	1	18th do.
Poona ...	Haveli ...	Poona City ...	4	—	4	4	Do.
Surat ...	Pardi... ...	Udawad	2	—	2	2	19th do.
Kaira... ...	Nadiád ...	Nadiád	1	—	1	1	20th do.
Do.	Anand ...	Anand	3	—	3	3	Do.
Kolába ...	Pen	Wadkhale, Peta Kalve.	1	—	1	1	21st do.
Do. ...	Panvel ...	Panvel	5	—	5	5	22nd do.
Surat ...	Jalálpur ...	Medhar	1	—	1	1	23rd do.
Thána ...	Bassein ...	Agáshi	2	—	2	2	24th do.
Do. ...	Wáda ...	Wáda	1	—	1	1	25th do.
Kolába ...	Alibág ...	Alibág	1	—	1	1	Do.
Hyderabad ...	Kandiarao ...	Halamni	1	—	1	1	27th do.
Surat ...	Jalálpur ...	Panar	1	—	1	1	28th do.
Thána ...	Bassein ...	Watar	1	—	1	1	29th do.
Broach ...	Kapadvanj ...	Charkalasi ...	1	—	1	1	Do.
Thána ...	Bassein ...	Bassein	1	—	1	1	30th do.
Shikárpur ...	Shikárpur ...	Shikárpur ...	1	—	1	1	Do.
Thána ...	Sálsette ...	Pahadi	1	—	1	1	31st do.
Kolába ...	Karjat ...	Halnali	1	—	1	1	Do.
			194	2,714	2,908	2,086	

During 1896 dysentery and diarrhœa caused the deaths of 19,423 males and 16,623 females, or a total of 36,046 persons against 35,348 in 1895, and a decennial mean of 38,504. Dysentery and diarrhœa.

The Western Registration District heads the list with a ratio of 3·11 per 1,000 against 2·50 in 1895 and 2·85 the decennial mean. The Central Registration District comes next with a ratio of 2·70, the Southern Registration District 2·16, the Gujarát Registration

District 0·27 ; and the Sind Registration District 0·15. In the Presidency the rate was 1·92 against 1·88 in the previous year and a decennial mean of 2·18. All the collectorates in the Western and Gujarát Registration Districts shew higher rates than in the previous year, and four out of the five collectorates in Sind. The collectorates of Ahmednagar, Poona, Sholápur and Sátára in the Central and Bijápur and Kánara in the Southern Registration Districts alone shew lower ratios than in 1895. High ratios were recorded in Násik 4·73, Belgaum 3·88, Khándesh 3·31, Ahmednagar 3·14 ; and the lowest 0·09 in Thar and Párkar, 0·08 in Shikárpur and 0·05 in the Upper Sind Frontier, which however are higher than last year.

During the first eight months from January to August the deaths from dysentery and diarrhœa exceeded those recorded in 1895, and then at the close of the year they were less. The ten years' mean was exceeded in the months from May to August. The maximum mortality occurred in August as last year and the minimum in March. In the previous year the least mortality occurred in February. As usual, the rise in mortality takes place at the end of the hot season, increases during the rains and gradually diminishes as the cold weather sets in.

Injuries. During 1896, 3,620 males and 2,618 females or a total of 6,238 persons met with violent deaths. The mortality from these causes is more by 187 than that reported in 1895, when 6,051 deaths were recorded. Of the 6,328 deaths 2,660 occurred from drowning, 1,286 resulted from snake-bites, 678 from wounds, 206 from hanging, 130 from poisoning, 97 from attacks by wild beasts, and 1,181 from causes not specified.

Other causes. The recorded deaths from causes other than those specified number 100,112, of which 51,947 occurred among males and 48,165 among females. The total for 1895 was 97,104, so there is an increase of 3,008 under this head.

Sanitary Works—Military and Civil.

All available information under these sections has been thrown in a tabular form, and will be found in Appendices Nos. IV, V and the last four columns of Annual Form II, Appendix VII.*

It will be seen from the statement given in Appendix V that, excluding the Varungaon Municipality which has been abolished, there were 167 Municipalities in the mofussil with a population of 2,232,737 souls and an income of Rs. 55,22,074. Out of this income Rs. 25,01,157 or 45·29 were allotted for sanitary works, and out of this allotment Rs. 22,37,959 or 89·48 per cent. were spent.

Of the total expenditure Rs. 11,06,662 or 49·45 were spent on conservancy, Rs. 6,47,329 or 28·93 per cent. were spent on improvement of water-supply, Rs. 2,22,905 or 9·96 per cent. on improvement of town-sites, Rs. 54,606 or 2·44 per cent. were spent on construction and repairs of markets and slaughter-houses, Rs. 9·413 or 0·42 per cent. were spent on sanitary arrangements during fairs and festivals, and Rs. 1,97,044 or 8·80 per cent. were spent on other sanitary objects, including construction and repairs of tanks, &c.

The Bombay Village Sanitation Act of 1889 under the conditions laid down in Government Circular No. 45, dated 5th January 1895, and under a modified form sanctioned in Government Resolution No. 1090, dated 6th March 1896, has been introduced in 59 other villages during the year 1896, making a total of 222 villages since the introduction of the Act. There still remains two districts, Kánara and Upper Sind Frontier, in which the Village Sanitation Act has not yet been brought into force. In some of the villages of the Ahmedabad, Broach, Surat and Násik Collectorates, Sanitary Committees have been appointed by the Collectors in a modified form, and at Shuklatirth in Broach Táluka of the Broach Collectorate Government in their Resolution in the General Department, No. 5279, dated 2nd December 1896, sanctioned an annual grant from Provincial Revenues of Rs. 200 to the Sanitary Committee waiving all the conditions of the Circular noted above. Under the modified form Government have ruled in their Resolution No. 3187 of 2nd July 1896, General Department, that under section 11 of the Village Sanitation Act a Committee may make a variety of rules regarding the sanitation of the village, some of which need involve no expenditure and can be enforced by the Committee acting magisterially under section 14. The Committee may also be useful as a means of conveying the suggestions of the District and Sanitary officers to the villagers, and inducing their adoption by example or persuasion. The experiment tried by the Collector of Surat in the case of Olpád has proved successful. The villagers themselves

*Not reprinted.

have collected money and engaged a small staff of sweepers. Though similar experiments in another villages may not positively be rewarded with such success, the case of Olpád is encouraging. And if the Collectors, where the conditions of Circular No. 45 of 1895 are impossible, tried to apply the modified form as suggested in Government Resolution No. 1090 of 1896, in the General Department, many villages before long will come under the operation of the Act with a promise of keeping the villages clean under the orders of the Committees appointed and empowered by Collectors and sanctioned by Government.

Personal Proceedings and General Remarks.

The year 1896 has been a very unhealthy one. In the early part of the year there was an outbreak of small-pox, chiefly in the Western and Gujarát Registration Districts. Then cholera appeared in the Western, Central and Southern Registration Districts, and the mortality was largely in excess of last year. The outbreak was most severe during July and August. Upon this, towards the middle of the rains, occurred the outbreak of plague in Bombay City, and then, owing to the early cessation of the rain, widespread scarcity necessitating the opening of famine works began.

Owing to being engaged first with measures for combating the plague and later on in organising the hospital arrangements for the relief of the sick at the famine camps and visiting various famine districts, the towns visited and reported upon are not so numerous as usual.

Famine.

Owing to the insufficiency of the rainfall after July it was anticipated that there would be scarcity in several of the Deccan districts, if the fall of rain did not occur in October. As will be seen from the slight meteorological sketch given on p. 165 the rainfall did not take place. In the beginning of November arrangements were made to meet the approaching distress, and the opening of famine works was sanctioned in the districts of Násik, Poona, Sátára, Ahmednagar, Sholápur, Bijápur and Belgaum, and I was directed to take steps for the inspection of the sites for camps for the workers, to arrange for medical aid to the camps and supervise the sanitary arrangements. Accordingly the Deputy Sanitary Commissioner, Southern Registration District, was directed to inspect the camp sites in the Bijápur and Belgaum districts. The Deputy Sanitary Commissioner, Central Registration District, inspected the Ahmednagar and Sholápur Collectorates. The Deputy Sanitary Commissioner, Western Registration District, the Násik District, whilst I inspected the sites in the Poona and Sátára districts.

The sites chosen for camps were generally approved of and the places for hospitals and trench latrines fixed, and the following sanitary recommendations were made :—Workers were not to be allowed to put up their own shelters where they liked. Even if hutting materials were not available, the lines for a camp were to be marked out and spaces allotted to the workers on which to put up their own temporary shelters if they chose.

Camps for 1,000 workers were laid out mostly on the following plan:—Huts 6 ft. × 6 ft. facing north and south in lines of five. North of the huts was a space of 50 ft. to the next line of huts, and on east and west a roadway of 20 ft. The huts might be closed up on the south side, but were to be left open on the north to facilitate inspection. The hospital buildings were as a rule on the south-east or north-west of the camp, and the latrine trenches to the east or north-east. The hospital was to consist of a hut of two rooms, one for the Medical Officer and the other for the dispensary and drug-store. A general ward for 30 patients divided for males and females, an ulcer ward for 12 cases, diarrhœa and dysentery ward for 12 cases, and further east a small-pox ward for 6 cases and a cholera ward for 10 cases.

An enclosure with lean-to shelters was recommended for all non-working children, who could walk, to stay in during the working hours, so that they should not interfere with the workers and foul the working camp. Also the dwelling camp was to be entirely cleared of all people during the working hours, except the guards and those who had to clean the camp. This was very necessary, as old people and children used to occupy the huts and defilement was going on all day.

In order to preserve the purity of the water-supply of camps, which was mostly from wells or running streams, it was recommended that the whole supply should be taken from wells which, if not already existing, could be roughly sunk in the beds of streams, and then a bhisti service organised to draw the water in clean vessels and deliver it into large receptacles near the camp, from which it could be served out to workers as required. Except these

bhistis, no other workers were to be allowed near the wells, which were, from time to time as occasion required and when cholera prevailed, disinfected with permanganate of potash.

Great difficulty was experienced in getting the workers to use the trench latrines, and it was only on the large camps over which the supervision was very strict that the orders could be regularly enforced.

As it was soon perceived that the numbers of workers and of camps would be largest in the Ahmednagar, Sholápur and Bijápur districts, the services of three Commissioned Medical Officers were applied for with the view of posting one to each collectorate as a District Medical Officer, and at first Surgeon-Captain Lloyd Jones was posted to Ahmednagar, Surgeon-Lieutenant Standage to Sholápur, and Surgeon-Captain T. B. Smith to Bijápur.

Regarding the supply of Assistant Surgeons and Hospital Assistants to act as Medical Officers at relief camp hospitals, the demand was more than could be supplied owing to the prevalence of plague. The Surgeon-General with the Government of Bombay supplied as many as were available, and on his representation Government were pleased to sanction the employment of temporary Hospital Assistants for famine duty, and later on, as large and more permanent camps were formed, the engagement of temporary Assistant Surgeons. Even with this there were not enough men, but by placing the medical officers centrally and directing them to visit twice a week the relief camps within a certain distance, sometimes 8 to 10 miles off, and by utilizing, with the permission of the Surgeon-General, the services of the medical men in charge of dispensaries, medical supervision and aid was afforded to a large number of camps and workers. Fortunately also the health of the workers was to the close of the year extremely good. There was no cholera and very little small-pox, but the medical officers did very hard work in constantly inspecting and reporting upon the sanitary condition of the camps, and the health of the workers, examining the quality of the food supply, and also treating the out-patient ailments, which were numerous and consisted for the most part of conjunctivitis, guinea worm, injuries of a trifling nature, and occasional attacks of fever and diarrhœa. I have great pleasure in bringing to the notice of Government the meritorious conduct of the great majority of these officers and the hard work they have cheerfully done, and I trust when the Famine Code is next amended that a definite scale of travelling allowance, and permanent advance for ordinary hospital expenditure will be laid down, as the want of definite ruling has caused a large amount of correspondence and a good deal of hardship and irritation. The allowance granted in ordinary times is quite insufficient in areas where distress is prevalent. The Dispensary medical officers who were ordered to attend famine relief camps, in addition to their own duties, should not be forgotten either.

The medical officers placed on famine duty were at first distributed to Bijápur 8, Sholápur 8, Ahmednagar 4, Sátára 4, Poona 4, Belgaum 3, and Násik 1. According to scale laid down each medical officer was supplied with medicines and instruments and appliances, and a set of furniture. Diet scales and a list of hospital comforts and petty supplies allowed were issued, and a small hospital establishment was also sanctioned.

The condition of weavers was carefully enquired into as it was considered that they would not be able to stand the different kind of work and the scale of food allowed, and it was found as the result of constant enquiry that, with the exception of the old people, the work they did and the food they got did not cause any deterioration.

A scale for the diet of confined women and recommendations regarding nursing mothers and infants were also made.

The numbers on famine relief works in each district affected are given below, and then the death rates for each district from July to the end of the year, contrasted with the ten-year mean. Up to the end of the year no one was reported to have died of starvation.

Statement shewing the number of workers in Famine Relief Camps at the close of 1896.

District.	Population according to Census of 1891.	Number of workers.
Bijápur	796,286	229,895
Sholápur	750,255	277,971
Ahmednagar	887,656	97,333
Poona	1,061,449	61,512
Násik	841,087	74,449
Sátára	1,225,511	67,731
Belgaum	1,011,453	10,813

Number.	District.	Death-rate from all causes per 1,000 of Population.											
		July.		August.		September.		October.		November.		December.	
		The monthly mean for 10 years.	July 1896.	The monthly mean for 10 years.	August 1896.	The monthly mean for 10 years.	September 1896.	The monthly mean for 10 years.	October 1896.	The monthly mean for 10 years.	November 1896.	The monthly mean for 10 years.	December 1896.
	Central Division.												
1	Ahmednagar	4·30	6·43	4·59	5·04	3·66	2·81	3·24	2·10	2·67	2·13	2·34	2·12
2	Násik	3·16	3·92	3·55	4·53	3·03	3·19	2·69	2·86	2·96	3·29	2·83	3·28
3	Poona	3·10	4·13	3·58	4·98	2·95	2·48	2·53	2·08	2·39	1·97	2·35	2·20
4	Sátára	3·17	3·84	3·50	3·95	3·17	3·06	2·92	2·69	2·53	2·18	2·37	2·27
5	Sholápur	3·81	2·98	4·03	3·27	3·37	2·68	3·03	2·25	2·67	1·80	2·48	1·81
	Southern Division.												
1	Belgaum	2·88	3·41	2·71	3·03	2·36	2·22	2·30	2·14	2·13	2·02	2·16	2·42
2	Bijápur	2·92	3·29	2·97	2·53	2·59	1·90	2·41	1·89	2·22	1·80	2·05	1·96

Sanitary Board.—During the year the Sanitary Board gave advice regarding the water-supply schemes of Surat and Rander, Malegaon, Islampur, and submitted a report on the Sátára water supply. They also advised on the sewage farm at Ahmedabad, on the Motlibai and Petit Hospitals, Bombay, the Lunatic Asylum and the Sassoon Hospital at Poona, and the Sukkur drainage works. The Board also gave advice on a number of miscellaneous projects.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER 1896.

The following table gives a summary of the shipping and health of the port of Bombay and of the work in connection therewith for the year ending 31st December 1896 :—

Vessels including Native Craft.	Number.	Number of Passengers as far as is known.	Number of Vessels Inspected.	Number of Persons including Crew on Vessels Inspected.	Number of Vessels Disinfected.	Number of Persons Vaccinated.	Diseases and Number of Cases of Each.						
							Bubonic Plague.	Cholera.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Enteric Fever.
Entered	47,948	423,966	22	21,654	14	601	2	1	5	5	3	5	1
Left	39,695	459,939	503	90,624	—	—	—	—	—	—	—	—	—
		Including Harbour Population.											
In harbour during the year.	1,310	22,142	45	—	45	176	—	37	7	4	—	1	—
Total ...	88,953	906,047	570	112,278	59	777	2	38	12	9	3	6	1
1895 ...	90,317	901,370	572	100,016	19	879	—	22	7	21	2	5	1

In the above table the "number of crew" on board ships entering the harbour is not shewn, as no record is kept. The discrepancy between "arrivals" and "departures" is explained by the fact of boats arriving with grass, wood, and other local cargo, from across the harbour being registered as "arrivals," without being registered as "departures" when they again leave for similar cargo.

The following table furnishes further particulars regarding vessels which entered the port during the year :—

Year.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which entered Bombay Harbour from Indian Ports.	Number of Passengers.
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1896	684	43,527	235	1,886	1,344	378,553	45,685	Unknown
1895	758	38,745	334	1,856	1,248	419,882	45,870	Do.

There is no record kept of the crews of incoming vessels, and, in the case of native craft, none of either crews or passengers ; hence the total number of persons who arrived

by the vessels shewn in the above table cannot be given. Of the 423,966 passengers shewn, 15,598 were troops, 9,892 pilgrims from the Hedjaz, and the remaining 398,476 chiefly passengers from ports near Bombay.

The following table shews the number of ships which had infectious disease on board on or before entering the harbour :—

Class of Vessels.	Number of Ships.	Total Number of Crew and Passengers.	Diseases and Number of Cases of Each.							Number of Persons Vaccinated.
			Bubonic Plague.	Cholera.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Enteric Fever.	
1. Troopships	4	5,476	—	—	—	2	2	4	1	—
2. Pilgrim ships	3	2,374	—	—	4	—	—	—	—	546
3. Other vessels	7	1,254	2	1	1	3	1	1	—	55
Total	14	9,104	2	1	5	5	3	5	1	601
1895	9	5,318	—	11	3	21	1	2	1	864

Vessels which became infected while in port are not shewn in the above table but are given in table on page 178.

The cases of measles, scarlatina, and chicken-pox, referred to in the foregoing table as having occurred on board the Indian Troop Service Transports, were landed and isolated in the military cantonment at Colába. The small-pox cases were removed to hospital on shore and those unprotected amongst the crew and passengers were vaccinated before they were allowed to land. During the year under report 601 persons were vaccinated on board the small-pox infected ships which are mentioned in the above table. Two deaths from plague were landed by a Shepherd's coasting boat which was put back from sea a day after her departure from Bombay on account of cyclonic weather. One death from cholera occurred during a voyage of a Shepherd's steamer from Marmagoa to Bombay. All these ships were thoroughly disinfected on their arrival at Bombay before pratique was granted them.

No vessels arrived during the year with suspicious cargo, infected cattle, or glandered horses.

The following table shews the number of vessels of all kinds which sailed from the port of Bombay during the year :—

Year.	Total Number of Steamers and square-rigged Vessels which left Bombay Harbour for Ports other than Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which left Bombay Harbour for Ports other than Indian Ports.	Number of Passengers.	Total Number of Steamers and square rigged Vessels which left Bombay Harbour for Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which left Bombay Harbour for Indian Ports.	Number of Passengers.
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1896	704	55,686	258	148	1,276	404,105	37,457	Unknown
1895	664	44,745	562	926	1,338	373,074	38,204	Do.

The following table furnishes details of outward vessels of all kinds, bound for Quarantine Ports, which were inspected during the year and granted B Form Bill of Health. By Quarantine Ports are meant ports of Mauritius, Aden, Red Sea, Europe

viâ Canal and Persian Gulf, vessels for which, with their crews and passengers, are inspected on the dates of sailing before Bills of Health are given. This table includes 19 pilgrim ships bound for Jeddah.

Names of ports to which sailed.	Number of vessels.	Number of Tonnage (net).	Number of individuals comprising crews.	Number of passengers.	Total of crews and passengers.
I.—Square-rigged Vessels and Steamers.					
Europe, *viâ* the Suez Canal ...	217	527,799·51	18,915	8,138	27,053
Aden	38	70,394·47	5,432	3,452	8,884
Red Sea Ports	15	18,907·74	879	667	1,546
Suez	3	5,711·76	92	1	93
Port Said	9	18,909·24	333	—	333
Mauritius	16	16,219·02	880	1,696	2,576
Persian Gulf	38	45,283·68	1,931	1,297	3,228
Total	336	703,225·42	28,462	15,251	43,713
II.—Pilgrim ships with 60 or more adult passengers.					
Jeddah, *viâ* Aden	19	25,810·90	1,428	14,478	15,906
Total	19	25,810·90	1,428	14,478	15,906
III.—Native Sailing Craft.					
Persian Gulf Ports...	61	8,744·91	1,367	100	1,467
Other Foreign Ports	43	4,588·01	928	109	1,037
Total	104	13,332·92	2,295	209	2,504
IV.—Her Majesty's Indian Troop and Marine Ships and British and Foreign Men-of-War.					
Europe, *viâ* the Suez Canal ...	15	62,905·	3,175	14,613	17,788
Aden	5	8,007·42	611	2,440	3,051
Suakim	14	36,356·19	1,607	3,867	5,474
Mauritius	3	7,223·42	730	708	1,438
Persian Gulf	7	7,684·50	750	—	750
Total	44	122,176·53	6,873	21,628	28,501
Grand Total... ...	503	864,545·77	39,058	51,566	90,624
1895	540	794,588·02	35,367	45,509	80,876

In addition to the above, Form C Bill of Health was issued to 648 vessels. This form is usually taken by vessels bound for Indian, Chinese and East African Ports, where quarantine restrictions are mild, or are only enforced against arrivals from infected ports. Thus the total number of Bills of Health issued during the year was 1,151 against 1,206 in the year 1895 and 1,177 in the year 1894.

The remaining 38,544 vessels did not take Bills of Health, being either only coasting craft or Shepherd and Company's ferry steamers.

Attached to each Bill of Health was a necrological certificate shewing the number of deaths from plague, yellow fever and cholera in the Town of Bombay during the week preceding that in which each vessel sailed, as these certificates have to be produced in certain ports. All Bills of Health issued up to the 29th of September 1896 were clean ones. On that date, however, as the Medical Board reported that there had been several cases of bubonoid fever, the necrological certificate, the end of which usually reads "that "the public health of the environs was good," was made to read "that the public health of "the environs was poor, several cases of bubonoid fever having occurred during the past "month in the Mandvi District," until the 8th of October 1896, when bubonic plague was declared to be mildly prevalent in the Mandvi District, and Bills of Health were modified

as follows, viz. :—Form B, the end of which usually reads, " It is certified that the Town " and Port of Bombay are at present free from epidemic cholera, plague, yellow fever, and " all other dangerous epidemic disease " was made to read " It is certified that the Town " and Port of Bombay are at present free from epidemic cholera, yellow fever and all other " dangerous epidemic disease, except bubonic plague which exists in a mildly epidemic " form in the Mandvi district," and the necrological certificate further modified and made to read " that the public health of the environs was poor on account of the presence of " bubonic plague in a mildly epidemic form in the Mandvi District." From the 10th of December 1896, until the end of the year, as the plague had extended into other districts and assumed an epidemic form, the bills of health were further modified as follows :—viz. Form B to read : " It is further certified that the Town and Port of Bombay are at present " free from epidemic cholera, yellow fever and all other dangerous epidemic disease except " bubonic plague which exists in an epidemic form " ; and Form C to read : " This is to " certify that there is no epidemic disease prevailing in the city and suburbs of Bombay " except bubonic plague which exists in an epidemic form."

There were no cases of infectious disease dangerous to life found, on inspection of any vessel prior to departure.

The sanitary condition of outward-bound vessels was, as a rule, satisfactory. The principal defects noticed were much the same as in other years, viz. :—

(*a*) Overcrowding of crews' quarters.
(*b*) Faulty construction of crews' quarters.
(*c*) Want of proper accommodation for deck passengers on long voyages.
(*d*) Foul bilges in native craft.

As in previous years, overcrowding of crews' quarters was chiefly observed among the regular liners so constructed as to carry as many passengers as possible, and is occasioned by vessels often having to take home an extra crew to man some other vessel of the same line. Such extra crew has to be provided with accommodation, and endeavours to accommodate its members with their boxes, in quarters already nearly full, leads to overcrowding. There has been a tendency among Commanders of vessels, which do not belong to the regular passenger liners, to provide temporary accommodation for such extra crews, when possible, and this was, in most cases, done in consultation with the Health Officer of the Port during the year ; but this procedure is not generally feasible in the case of vessels constructed to carry passengers in every available corner, and with very few exceptions, was not attempted, those responsible generally urging, by way of explanation, the fact that the permanent quarters were much in excess of the minimum space required by law, and that the extra hands accommodated did not cause such minimum to be reduced. However true that may be theoretically, in practice it is attended with much disadvantage as necessity arises for erecting hammocks, which with men's kit and boxes not only do diminish the minimum space per head required by law, but also render it very difficult to keep quarters clean and sanitary. These remarks apply to those vessels only which were inspected, and it is highly probable that they would also apply to a large number of outgoing vessels which do not undergo inspection by the Health Officer of the Port. In the case of one vessel, a pilgrim liner, notice was given to the owners that the Health Officer of the Port would feel justified in withholding a bill of health unless the crews' quarters were improved.

A large number of iron-decked vessels were inspected during the year, and found to have no wooden sheathing on the deck over the crews' quarters or within these quarters. The number of iron-decked vessels is increasing, but the new ones are bound by law to have their crews' quarters sheathed within and without ; this law does not apply to the old ones unless complaints regarding them be made and sustained. In many cases wooden planks have been placed under the decks over the bunks, but these are of very questionable utility, and harbour vermin. Cases of this were only observed during the year upon several buggalows, which were granted Form B bill of health. Upon steamers it was not observed to any extent, but this remark only applies to those steamers which were inspected. Many vessels of all kinds proceed on long voyages which do not have to undergo inspection, and it is possible that some of these may require better accommodation for deck passengers than they possess.

In only a very small number of instances steps had to be taken on account of dirty bilges in native craft, as Nácodas have been becoming more careful. In the case of one buggalow, in which the bilge was unusually foul, a specimen was taken and subjected to quantitative bacteriological examination, and found to contain no less than 5,400,000 microbes to one cubic centimetre.

Infectious Disease on Vessels in the Harbour.—The following table includes all steamers, square-rigged vessels and native craft, which became infected while lying in port, but not those given in the table on page 175, which became infected while at sea :—

Months.*	STEAMERS.									BUGGALOWS, TONIES, PROWS, STEAM LAUNCHES, &C.										TOTAL NUMBER OF CASES OF INFECTIOUS DISEASE IN THE BOMBAY HARBOUR.									
	Number of Ships.	Cholera.		Small-pox.		Measles.		Chicken-pox.		Number of Native Craft.	Cholera.		Small-pox.		Measles.		Chicken-pox.		Total number of infected Vessels.	Cholera.		Small-pox.		Measles		Chicken-pox.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
January ..	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—
February .	2	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	2	—	—	—	—	—
March ..	5	—	—	2	—	3	—	1	—	4	5	4	—	—	—	—	—	—	9	5	4	2	—	3	—	1	—
April ..	1	—	—	1	—	—	—	—	—	19	20	11	—	—	—	—	—	—	20	20	11	1	—	—	—	—	—
May ..	1	—	—	—	—	1	—	—	—	2	2	1	—	—	—	—	—	—	3	2	1	—	—	1	—	—	—
June ..	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—
July ..	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—
August ..	1	1	—	—	—	—	—	—	—	6	6	5	—	—	—	—	—	—	7	7	5	—	—	—	—	—	—
September	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—
Total ..																			45	37	22	7	—	4	—	1	—
1895 ..																			12	11	7	4	—	—	—	2	—

* No cases of infectious disease occurred in the Bombay Harbour during October, November, and December.

Out of a harbour population estimated at 22,142 there were 37 cases of cholera, 22 of which proved fatal. These cases were distributed as follows :—

1 Steamer ... ... 1 case.
33 Prows, Tonies, Dingies, Buttelas, &c. (native craft) ... ... 36 cases.

Of other diseases the following are the details :—Out of the seven cases of small-pox shewn in the foregoing table, three occurred on board of three of Her Majesty's Indian Marine Ships, and the remaining four on board of P. & O. vessels and other steamers which were in the harbour at the time. Out of the four cases of measles, two occurred on board Her Majesty's Ship "*Warren Hastings*," and one on board Her Majesty's Ship "*Maydala*," and one on a British India Ship. The case of chicken-pox was reported to have been removed to the Saint George's Hospital from one of the Indian Marine Ships. All these vessels were disinfected as thoroughly as possible. In connection with seven cases of small-pox, 176 persons were vaccinated.

The following table shews reported cases of cholera on native craft of all kinds in the port during the past 12 years. It is possible that the apparent high death-rate is due to the fact that mild cases ending in recovery are not reported. It was observed that the fatal cases pursued a very rapid course, but this is probably due to inaccurate and unreliable reports :—

Years.	Cases.	Deaths.	Percentage of deaths amongst those attacked.	Years.	Cases.	Deaths.	Percentage of deaths amongst those attacked.
1885	30	26	86	1892	12	12	100
1886	2	2	100	1893	12	12	100
1887	26	21	80	1894	28	22	78
1888	15	10	66	1895	10	7	70
1889	23	21	91	1896	36	22	61
1890	3	2	66				
1891	5	5	100	Total ...	202	162	80

Disinfection of Ships and General Health of the Shipping.—Fifty-nine vessels of various kinds were disinfected during the year, under the supervision of the Water Police, according to directions given by the Port Health Officer. The Naval Authorities dealt with the disinfection of Her Majesty's Marine and Indian Troopships on which infectious disease occurred. No opposition was raised by Commanders and owners.

The health of the harbour population was satisfactory during the year. The following details shew the distribution of the admissions into the various hospitals:—The Saint George's Hospital during that time admitted 504 Europeans, of whom 12 died; whilst the Jamsetji Jijibhoy Hospital admitted 86 natives, of whom 9 died; and the Gokuldas Tejpal Hospital 120 natives, of whom 8 died. The total number of admissions into these hospitals were 710 and the number of deaths 29.

Sixteen inquests were held by the Coroner of Bombay during the year on bodies of persons who died from the effects of accidents while at work on board ships in docks and at bandar or in the harbour. There were no cases of bilge-poisoning reported during the year.

Quarantine against Bombay.—The following table shews the action taken in other ports during the year against Bombay on account of the prevalence of bubonic plague :—

Authority or Government Resolution. No.	Date.	Name of Port at which Quarantine was imposed.	Remarks.
4358	3rd October 1896 ...	Ceylon	Quarantine on vessels until inspected.
4395	5th October 1896 ...	Alexandria	Application of plague rules in force since 13th June 1894 to arrivals from Bombay.
4431	7th October 1896 ...	Ceylon	Strict quarantine of vessels from Bombay.
4434	Do. ...	Bussorah	21 days' quarantine.
4435	Do. ...	Aden, Perim and Somáli Coast.	Application of plague rules similar to those in Bombay Notification No. 2780 of 26th July 1894, to arrivals from Bombay.
4540	13th October 1896 ...	Turkish Ports ...	10 days' quarantine.
4570	14th October 1896 ...	Spain	Quarantine in Spain on arrivals from Bombay after 10th September 1896.
4557	Do. ...	Ceylon	8 days' quarantine on arrivals from Bombay after 10th September 1896.
4585	16th October 1896 ...	Persian Authorities ...	Imposing quarantine on arrivals from Bombay.
4607	17th October 1896 ...	Goa	5 days' quarantine against passengers from Bombay arriving by rail or sea.
4629	20th October 1896 ...	Madras, Calcutta and Rangoon.	Issue of quarantine rules against Bombay similar to those of 26th July 1894.
4673	21st October 1896 ...	Calcutta	8 days. Vessels on which no disease has occurred exempted, provided they carry Medical Officer or have been granted pratique at Colombo and other intermediate ports.
4729	24th October 1896 ...	Goa	5 days' quarantine against passenges by steamers from the date of their arrival from Bombay.
4774	27th October 1896 ...	Alexandria	All ships coming from plague-infected ports for Suakim even shewing clean bills of health during voyage must disinfect first at Moses Wells.
4852	30th October 1896 ...	Dutch Colonies ...	Enforcement of usual quarantine rules against arrivals from Bombay.
4885	3rd November 1896 ...	Bushire	8 days dating from departure from East Indian Port.
4916	7th November 1896 ...	Singapore	Bombay declared infected from 6th November 1896.
5105	21st November 1896...	Do.	Vessels from Bombay *via* Colombo admitted free if they bring a clean bill of health from the latter port, while vessels arriving direct will be admitted to pratique if no cases of plague therefrom has occurred on board during the eight days preceding their arrival.

No quarantine was imposed during the year at Suez against arrivals from Bombay. The following table shews the number of days during which quarantine was in force at Suez against arrivals from Bombay since the year 1884, with the number of deaths from cholera in Bombay each month :—

Year	Number of days at Suez during which Quarantine was in force against Bombay.	Total Number of Cholera Deaths in Bombay City for the Year.	Number of Cholera Deaths in Bombay City for each Month.												Remarks.
			January.	February.	March.	April.	May.	June	July.	August.	September.	October.	November.	December.	
1884	250	576	101	33	34	7	70	19	8	73	94	47	50	40	
1885	227	598	49	80	149	114	62	23	53	34	20	11	1	2	
1886	13	19	3	2	—	1	2	2	—	—	5	—	1	2	
1887	66	269	—	1	2	3	1	8	45	103	48	41	15	2	
1888	6	379	5	1	10	36	40	54	38	75	68	16	7	29	
1889	113	462	108	29	8	14	26	34	108	67	32	12	13	11	
1890	Nil	102	40	15	9	—	1	3	12	7	7	2	1	5	
1891	18	146	1	1	4	1	1	1	6	33	73	19	6	—	
1892	Nil	169	1	2	1	12	17	12	26	29	29	27	10	3	
1893	Nil	147	4	—	3	23	23	10	11	31	35	6	1	—	
1894	Nil	426	1	1	2	8	53	61	134	131	22	8	3	2	Cholera was declared to be of an epidemic form between 17th July and 7th August 1894.
1895	Nil	90	3	—	1	2	8	1	3	8	4	12	38	10	
1896	Nil	490	8	2	17	43	83	54	82	143	47	7	2	2	

Red Sea Pilgrim Traffic.—The new Pilgrim Act of 1895 came into force on the 6th of October 1896, and those vessels which sailed after that date, with the exception of the S.S. "*Naderi*," are considered pilgrim ships under that Act, while all those shewn as having sailed before that date were considered pilgrim ships under the Native Passenger Ships Act.

Nineteen pilgrim ships sailed for Jeddah during the year with 14,167 pilgrims and 311 passengers for other ports. Under the Pilgrim Act of 1895 it is necessary that each pilgrim should have six square feet of free upper deck space in addition to 12 square feet on the 'tween or 16 square feet if travelling on the orlop deck. It is also necessary that exclusive of side scuttles and hatches, each pilgrim on the 'tween-decks should be provided with five square inches of ventilation, and on the orlop deck with ten square inches. None of those pilgrim vessels which left during the year under the new Act carried any pilgrims or passengers upon orlop decks.

The pilgrims as usual included all classes of Indian and Central Asian Mahomedans. Among them was observed the usual number of aged, lame, blind and very young. On the whole they were a fairly healthy lot. Stowaways were not numerous during the year.

Out of a total number of 14,167 pilgrims who sailed, there were 271 admissions into hospital on board and 49 deaths. The average duration of the voyages to Jeddah, not including the period of quarantine imposed at Camaran, was 14 days.

The medical inspection of all pilgrim ships was carried out in the Prince's Dock during the year and much valuable assistance was rendered by the officials of the Preventive Service under Messrs. Walsh and Blunt and by the Police under Mr. Lee-Smith, especially after the new Act came into force, when the inspections were tedious and of a complicated nature.

The usual ten days' quarantine was imposed upon all pilgrim-ships arriving just prior to the Haj (which in 1896 was on the 23rd May) at Camaran which was opened for the reception of pilgrims on the 18th of December 1895.

In addition to the above, fourteen vessels arrived from Jeddah with small batches of pilgrims and other passengers during the year.

The returning vessels were of the same class as those which made the outward voyages. Nineteen vessels embarked a total of 11,133 souls at Jeddah and Camaran. There were 365 admissions into hospital and 136 deaths.

Owing to small-pox existing on three vessels on arrival in Bombay, 546 pilgrims were vaccinated.

The difference between those who left for and those who returned from Arabia amounts to about 15 per cent. against 28 per cent. last year and an average of 33 per cent. in previous years.

Sanitary state of the harbour and foreshore.—Referring to Surgeon-Major MacCartie's Annual Report of 1895, he mentions eight bandars in which grave sanitary defects were observed : —

(1) *Victoria Bandar.*—He here stated that the 30-seat latrine was not sufficient ; there are now in addition 1 with 20 seats, 2 with 15 seats, 3 with 6 seats, 2 with 3 seats and 1 with 1 seat ; and the sanitary condition is much improved.

(2) *Mill Frontage from Jamsetji to Arthur Bandars.*—There is still insufficiency of latrine accommodation here and consequent fouling of the foreshore.

(3) *Arthur Basin.*—The nuisance caused by the discharge of the Tramway Company's drain has now ceased to exist.

(4) As pointed out last year by Surgeon-Major Crimmin, Mody Bay South Reclamation has ceased to be a nuisance as it has been taken up for a bulk oil installation.

(5) *Frere Bandar.*—There is still insufficient latrine accommodation and consequent much fouling of the foreshore where large gangs of coolies are employed.

(6) *Malet Bandar.*—There has been little if any improvement here, and the smell at low tide is most offensive. More latrine and urinal accommodation is urgently wanted.

(7) *Mazgaon Basin.*—The condition of this basin is much the same now as it was in 1895, and it is often very offensive at low water.

(8) *Kasára Basin.*—The drain is still above low-water mark, and the basin is in consequence still foul, and, as remarked by Surgeon-Major Crimmin last year, will probably remain so until the drain is included in the proposed Mázgaon Drainage System, or the basin filled in.

In addition to the above, the basin at Mody Bay North is offensive at low water, and it is reported that a large number of rats died here in October. There is also a large drain which discharges off Carnac Bandar, the smell from which is intolerable, and I found the water in the vicinity on bacteriological examination to contain 900,000 microbes per cubic centimetre.

Excepting the above remarks there has been a decided improvement in the state of the foreshore during the past few years owing chiefly to the exertions of the Port Trustees.

I conducted a large series of bacteriological experiments during the year for the quantitative examination of harbour water, and it is of interest to note that after high tide the current from the Thána river so effectually clears the foreshore that no trace whatever of any contamination is found in the middle of the harbour ; for example, although 900,000 microbes per cubic centimetre were found in Carnac Bandar, 10,000 near Apollo Bandar, and 14,000 near the Docks, in a line running from South Karanja to Sassoon Dock, a large number of specimens of water were collected at regular intervals of distance, during middle ebb-tide, and not one of them was found to contain more than 100 microbes per cubic centimetre, the practical significance of which will be understood when it is remembered that fresh water which does not contain more than 100 microbes per cubic centimetre is fit for drinking.

ABSTRACT OF REPORT OF THE CALCUTTA MUNICIPALITY FOR 1896-97.

(*Mr. R. Bright, Acting-Chairman.*)

Turning now to the history of the work done during the past year, the Commissioners consider that the record must be allowed to be satisfactory. The year, if it were memorable for nothing else, would be most noteworthy in the history of the town because it has witnessed the inception and commencement of sanitary works of the highest importance. These works are connected with—

(1) Unfiltered water supply.
(2) Drainage and sewerage.

As regards the former the scheme includes—

(*a*) Remodelling and extending the arrangements for supplying unfiltered water in the Town Area.
(*b*) Supplying unfiltered water to the Suburbs.

As regards the second series of works the scheme includes—

(*a*) Works necessary for the improvement of outfall of the Town system of sewerage.
(*b*) Drainage and sewerage of the Suburbs.

Extension of unfiltered water supply.—As regards the works which are designed for the improvement and extension of the unfiltered water-supply, it is hardly possible to exaggerate their importance. In a flat country like that upon which Calcutta is built, the sewers have, of necessity, to be laid with a fall which is quite insufficient for self-cleansing, and it is only by flushing that they can be kept in a state of proper cleanliness, and the sewage properly diluted. The present supply of unfiltered water, amounting to 5,625,163 gallons per diem, is insufficient even for street-watering, and proper flushing of the sewers is out of the question. Moreover, owing to the want of a proper supply of unfiltered water, the extension of the sewer system has been seriously impeded, and connections with private privies have been impossible. The work now undertaken by the Corporation will, it is hoped, not only greatly improve the state and efficiency of the existing sewers, but will also render possible connections of private privies with the sewers and thus in time largely diminish the night-soil establishment. In all ways and from all points of view, the Commissioners are of opinion that these works are of the highest importance for the improvement of the sanitation of the town.

The works sanctioned by the Commissioners to secure these ends were—

(1) Renovating and altering the engine-house at Mullick's Ghat.
(2) The construction of a new jetty to carry the necessary suction-pipes.
(3) The provision of engines with eight times the capacity of the present plant of 1,200 H.P.
(4) Additional mains to carry the increased supply to the principal streets of the town with the necessary arrangements to admit of the subsidiary pipes being gradually laid.

The progress made in this direction during the year has been substantial—

(1) The engine-house at Mullick's Ghat is being enlarged and altered at a cost of about Rs. 41,000.
(2) The jetty for the suction-pipes has been completed at a cost of Rs. 49,000.
(3) In April last a sum of £25,622 was sanctioned for the purchase of engines which, it is hoped, will shortly be at work.
(4) A tender of Messrs. Martin and Co., amounting to Rs. 5,52,361 for town and Rs. 4,93,514 for suburbs, for laying additional mains, has also been accepted, and 15,495 feet of these mains have been laid during the year out of a total estimated length of 3,05,400 feet.

As regards the provision of unfiltered water supply to the suburban area, it is proposed to move the plant now working at Mullick's Ghat to the river bank at Hastings and to construct an engine-house and jetty there, similar to the one at Mullick's Ghat. The land has been arranged for, contracts for shifting the engines have been entered into; in the suburbs most of the pipes have arrived, the work is being pushed on vigorously, and will, it is hoped, be finished during the current year.

Extension and improvement of the sewerage system.—Of equal or even greater importance are the works which have been commenced, with a view to improve the outfall of the

sewers of the town proper, to provide for the drainage of the Suburbs and of the area between the Canal and the Circular Road. The problem to be solved was one of great intricacy and has engaged the attention of this Corporation for several years past. The facts to be dealt with, in the case of the town area, may be thus described. The outfall for storm-water was defective, because the sewers of the town discharged into a channel of insufficient capacity, which was constantly liable to be blocked owing to the tide-levels at the outfall being too high to avoid flooding in the town, and the object of the proposed works is to provide a channel of sufficient capacity, with sufficient storage-room to hold the discharge of the sewers during the time the outfall is obstructed by the tide at a level which can have no dangerous effect in *banking* up the sewers. The capacity of the present pumping plant at Palmer's Bridge is insufficient to deal with the existing quantity of sewage, while the capacity of the present high level sewer is also too small. *A fortiori* these will be even more inadequate than they are at present, as soon as the burden of dealing with the sewage of the Suburbs is added.

To deal adequately with the sewage, larger pumps are to be fixed at Palmer's Bridge, a new high level sewer is to be constructed which will meet with a new high level sewer intended for the suburban outfall, and the combined sewage of the Town and Suburbs is to be carried in a channel lined with masonry to a new outfall some miles below the present one.

The second section of the drainage project provides for a main sewer from Watgunge on the banks of the Hooghly which will discharge at a station to be established near the Rifle-range.

The suburban outfall will be precisely similar to that now working at Palmer's Bridge.

The original plan provided for three pumping stations for the suburban main sewer, but more complete information has enabled Mr. Hughes to modify his plans, and there will now be only two pumping stations, one at the Budge-Budge Road and one at the outfall.

At the commencement of the year under report a preliminary project had been prepared by Mr. Hughes embodying his proposals. During the year surveys were made and details settled, plans and estimates were prepared and the work has been vigorously pushed on by the Commissioners ; contracts were entered into with Messrs. Martin and Co. for the storm-water and sewage outfall of the Town Proper on 10th October, 1896, and the foundation-stone of the drainage works was laid by His Honour the Lieutenant-Governor at Palmer's Bridge on the 26th November, 1896.

The contract for the section of the suburban drainage south of Tolly's Nullah was given to Messrs. Martin and Co. in October, and that for the Suburban Drainage, north of Tolly's Nullah, was given to Messrs. Burn and Co. by the General Committee on the 23rd April last. The progress of the work has been hindered by the delays inseparable from the proceedings for the acquisition of the land. As regards the town outfall works, good progress has been made in the manufacture of lime and bricks, and a considerable quantity of earth-work has been excavated, pipes have been laid for the supply of water to the labourers and rails and rolling-stocks for the tramway have arrived.

As regards the work for the sewers south of Tolly's Nullah, some progress has been made in the actual laying of the sewers.

The work for the system, north of Tolly's Nullah, was not commenced during the year under review.

As regards the project for the canal area the surveys are almost complete.

From the above facts it will be seen that these works and projects, which are of the highest importance to the sanitation of Calcutta and which involve engineering problems of great difficulty, have at last passed the stage of discussion and are on the fair way to completion.

The number of premises connected with the public sewers during the year was 448 bringing the total up to 29,588. The sewers, including 9·42 miles of bustee-sewers, now measure 209·341 miles excluding house-connections.

Simultaneously with the extension of the sewerage system to the Suburbs, there have been road projects undertaken which are of great importance to the Suburbs. The principal of these are the Badiapara Road, the Lansdowne Road extension, the high level sewer road, the improvement of the Hazra Road, the storm-water escape and sewer road, and the Kalighat Road. The suburban area will be greatly benefited by these roads, especially by the Lansdowne and Badiapara Roads, the latter of which does away with part of a very filthy quarter. Contracts for these two roads have been given out, and the work is in progress.

The new Kalighat Road has been completed during the year, and a project has been prepared for improving the Strand Road, while the extension of the Badiapara Road to Kalighat Road is under contemplation.

Turning aside from the large projects for dealing with the drainage of the Town and Suburbs, it is necessary to note that good progress has been made with the Suburban Drainage Temporary Project.

The pail and cart-depôt, at the Budge-Budge Road, has been working successfully since June, while the depôt No. 2 at Hazra Square has also been completed. All necessity for night-soil trenching at Bhatchala should be at an end, while necessity for trenching at Dhakooriah will almost cease.

Water Works.—Turning next to the Water Works Department the average daily consumption of filtered water has risen to 20,786,655 gallons, while that of unfiltered water has very slightly fallen from the figures of the previous year.

The demand for unfiltered water is far beyond the present means of supply. There has been some extension of both filtered and unfiltered pipes. Filtered water during the year was supplied to all bathing-platforms in place of an unfiltered supply.

The year's experience has brought one fact even more prominently to notice than usual. That it is impossible with the present mains, which were *constructed to carry a much smaller quantity of water*, to maintain the statutory head of pressure. These subjects are under the consideration of the Commissioners, and it is hoped that, after the supply of unfiltered water has been introduced, it may be possible to reduce the expenditure of filtered water within reasonable limits, and then to restore the head of pressure to its statutory amount.

The length of water main laid chiefly in small extensions on the distribution system during the year (filtered supply) was 1·47 miles. The total length of filtered water mains now amounts to 312·06 miles. In addition to this 5,882 feet of 3 inches and 72 feet of 2 inch-pipes have been laid to extend water-supply to Plague Hospital at Manicktollah. The number of premises connected during the year was 872. The total number of premises connected now amounts to 27,184.

The working of the C. and D. engines at Tallah caused great anxiety during the year, and a contract has been entered into with Messrs. Simpson and Co. for the supply of two Worthington pumps.

Miscellaneous.—In the other Departments too, important work has been done. The repairs to the Town Hall, which were of a most extensive character, were nearly completed by the end of the year. The question of the erection of a suitable Municipal Office was also discussed, and it was finally decided to build extensions of the existing building so as to allow of all the Departments being housed under one roof. This is a most desirable thing, and will, when completed, do much to facilitate work.

An estimate, amounting to Rs. 58,000, was sanctioned during the year for the construction of new knackery at Dhappa, which, it is hoped, will be completed during 1898-99, and which, when finished, will have the effect of doing away with the nuisance which at present undoubtedly exists.

The system of electric lighting in Harrison Road was improved at a cost of Rs. 10,600.

A most important change during the year has been the introduction of the contract system, by which large drainage and water work projects have been entrusted to responsible firms. The practice up to 1895-96 was to purchase pipes in England through an Agent and then lay them departmentally.

Health Department.—The last department which seems to call for notice in a brief summary of the history of the year is the Health Department. In this Department too there is a record of strenuous exertion.

The advent of the Plague in Bombay naturally gave rise to apprehensions that it would very probably appear in Calcutta, which is so closely connected with the city where the disease established itself.

With a view to provide against this contingency, a large temporary establishment was engaged in the cleansing of the town, a Chief Superintendent of Conservancy was appointed, and the extra expenditure thus involved resulted in an excess of Rs. 57,578 over the Budget estimate. The town generally, and the worst houses in Burra Bazaar and Jora Bagan, have had such a cleansing as they have never before received. An isolation hospital was also erected. Fortunately, the plague did not break out in the town.

The investigations which were made during the year into the sanitary condition of the town brought prominently into notice the extremely unsatisfactory state of the existing

law which regulates buildings. A Building Commission was appointed to consider the question, but their deliberations are not as yet concluded.

Health of the Town.—The birth-rate was higher than that recorded in any of the previous seven years, except 1892 and 1893. On the other hand, the mortality, while less than that of the preceding year, was in excess of the quinquennial average. Fever was prevalent to a considerable extent, and cholera prevailed with considerable virulence in March, April and May. On the other hand, the number of deaths from small-pox was exceptionally small.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1896.

(*Dr. W. J. Simpson.*)

Meteorology. The variations in the atmospheric pressure during the greater part of the year were small, the lowest reading 29·501 being recorded in July, and the highest 30·059 in December. The mean daily variations of temperature were greatest from January to May and October to December, and least in August. The mean daily dew-point was highest in July, August, and September, and the mean maximum solar radiation was highest in April. Rain fell during all the months except October and December, the number of rainy days during the year amounting to 109. The maximum monthly total rainfall and the maximum fall in 24 hours both occurred in June.

Price of food. The price of food was higher in 1896 than the average of the preceding ten years. Common rice sold in the average at Rs. 4-14-6 against Rs. 3-9-11 per maund. Fuel and salt sold at about the same prices as the average of the previous decennium ; but the average price of meat, fruit, fish, vegetables, *dal*, *ghee*, and oil was higher than the average of the preceding ten years.

Vital statistics. The number of births (born alive) recorded during the year 1896 was higher than that recorded in any of the previous seven years, except 1892 and 1893. There were 12,608 births, giving an annual birth-rate of 18·4 per 1,000 of population. The figures for the past eight years are as follows :—

Year.	No. of Births.	Birth-rate.
1889	12,317	18·0
1890	11,918	17·4
1891	12,477	18·3
1892	12,688	18·6
1893	13,492	19·7
1894	11,438	16·8
1895	10,945	16·0
1896	12,608	18·4

As usual, the greatest fertility was exhibited by the Christians and other classes, and the birth-rate was greater among the Hindus than among the Mahomedans. According to locality, the birth-rate was greatest in the added area of Burtollah, in Hastings, and in the town area of Shampooker, and was least in Waterloo Street, Burrabazar, and Jorabagan. The male births fell below the female births in three districts, viz., added area Moocheepara, Baniapooker, and Khidderpur, and male and female births were equal in number in two districts, viz., Puddopooker and Park Street ; in all the remaining wards the male births exceeded the female births, the excess being greatest in the added area of Shampooker, in Bamunbusti, Burrabazar, and Colootolah wards.

The general mortality of the town during 1896 was less than that of the previous year, but exceeded the average of the preceding five years. There were 24,356 deaths from all causes, being a mortality of 35·7 per 1,000 of the population against 27,031, or a ratio of 39·6 in 1895, and against 22,254 or a ratio of 32·7, the mean of the five years 1891 to 1895. The following figures give the numbers of deaths and death-rates in Calcutta during the past eight years :—

Years.	No. of Deaths.	Death-rates.
1889	19,564	28·7
1890	20,368	29·8
1891	21,517	31·5
1892	20,180	29·6
1893	20,103	29·5
1894	22,441	32·9
1895	27,031	39·6
1896	24,356	35·7

The decline in the public health in comparison to the previous five years was greater in the town area than in the suburban area, and in the area bordering on the Circular Canal than in the rest of the suburbs. The death-rate in the town proper rose to 33·1 in 1896 against 29·4, the average of the previous five years, while the death-rate in the Suburbs rose to 41·2 in 1896 against 39·6, the mean of the previous five years ; and the ratio in the canal area was 42·6 against 37·8, and in the rest of the suburbs 34·7, excluding the hospital deaths that cannot be referred to any of the wards of the town, against 34·2. In comparison with the five years from 1891 to 1895, the unhealthiness of the town was practically universal throughout the town area, the Park Street ward alone forming an exception, and even in that ward the public health was virtually the same in 1896 as in the previous five years ; but in the Suburbs, the three wards Ballygunge, Bhowanipur, and Alipur, shewed a decided improvement in the general health in comparison with the average of the five previous years, though the Suburbs generally shewed a deterioration in health from the previous five years.

Statement of Deaths from different causes during 1896.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1891.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	9. All other Causes.	10. Total Deaths from all Causes.	11. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes.	From all Causes. For the Year.	Mean of previous 5 Years.
	Shampooker	29,951	190	2	342	109	2	6	6	—	14	375	1,032	·6	·06	11·4	3·6	·46	12·5	34·7	31·8
	Coomartolly	26,614	196	5	283	106	3	1	10	—	14	299	903	7·3	·18	10·6	3·9	·52	11·2	33·9	30·9
	Burtollah	28,374	199	6	393	121	5	4	10	1	20	413	1,152	7·0	·21	13·8	4·2	·74	14·5	40·6	33·5
	Sukea's Street	25,750	127	1	299	80	3	1	9	—	13	355	875	4·9	·03	11·6	3·1	·5	13·7	33·9	29·3
	Jorabagan	39,180	262	11	554	128	—	2	14	—	16	404	1,375	6·6	·28	14·1	3·2	·4	10·3	35·0	32·3
	Mayo Hospital	—	12	—	1	3	1	—	3	—	4	9	29	—	—	—	—	—	—	—	—
	Jorasanko	41,617	272	3	570	154	2	8	16	—	26	559	1,584	6·5	·07	13·6	3·6	·62	13·4	38·0	33·1
	Burra Bazar	20,646	123	6	297	82	2	1	8	—	11	212	731	5·9	·28	14·3	3·9	·53	10·2	35·4	33·3
	Colootollah	50,781	222	3	824	135	5	6	20	—	31	501	1,722	4·3	·05	16·2	2·6	·61	9·9	33·7	29·2
	Medical College Hospital ..	—	21	—	7	23	1	1	5	—	7	152	210	—	—	—	—	—	—	—	—
	Moocheepara	39,109	166	1	615	109	2	—	5	—	7	481	1,379	4·2	·02	15·7	2·7	·17	12·2	35·2	33·3
	Police Hospital	—	3	—	4	—	—	—	—	—	—	4	11	—	—	—	—	—	—	—	—
	Bow Bazar	22,668	64	—	343	67	3	1	8	—	12	288	774	2·8	—	15·1	2·9	·52	12·7	34·1	29·1
	Puddopooker	20,761	96	—	233	60	1	1	10	—	12	295	696	4·6	—	11·2	2·8	·57	11·3	37·2	32·5
	Waterloo Street	6,083	25	—	45	7	1	—	6	—	7	48	132	4·1	—	7·3	1·1	1·1	7·8	21·7	14·3
	Fenwick Bazar	28,366	80	1	341	64	—	2	6	—	8	227	721	2·8	·03	12·0	2·2	·28	8·0	25·4	22·3
	Taltollah	29,207	81	—	438	89	1	2	7	—	10	303	921	2·7	—	14·9	3·0	·34	10·3	31·5	30·3
	Collinga	13,218	18	—	216	33	1	—	4	—	5	140	412	1·3	—	16·3	2·4	·37	10·5	31·1	30·7
	Park Street	4,320	13	—	31	11	—	—	—	—	—	20	75	2·8	—	6·7	2·3	—	4·3	16·4	16·6
	Bamun Bustee	4,598	26	1	76	20	—	—	1	—	1	53	177	5·6	·21	16·5	4·3	·21	11·5	38·4	36·3
	Hastings	4,820	28	—	115	25	—	—	2	—	2	65	235	5·8	—	23·8	5·1	·41	13·4	48·7	37·3
	Total	4,36,403	2,224	40	6,027	1,426	33	36	150	1	220	5,209	15,146	5·0	·09	13·8	3·2	·54	11·9	34·7	30·9
	Fort William	3,468	3	—	12	6	—	—	1	—	1	15	37	·86	—	3·4	1·7	·28	4·3	10·6	10·0
	Port of Calcutta	26,589	150	—	36	19	1	—	54	—	55	30	290	5·6	—	1·3	·71	2·0	1·1	10·9	6·1
	Total of Urban Calcutta ..	4,66,460	2,377	40	6,075	1,451	34	36	205	1	276	5,254	15,473	5·0	·08	13·0	3·1	·59	11·2	33·1	29·4
	Added Area, Shampooker ..	6,934	61	1	149	29	—	—	2	—	2	57	299	8·7	·14	21·4	4·1	·28	8·2	43·1	38·2
	Do. Burtollah	8,057	43	—	205	24	—	—	1	—	1	72	345	5·3	—	25·4	2·9	·12	8·9	42·8	39·9
	Do. Sukea's Street ..	9,078	61	—	202	51	—	—	1	—	1	111	426	6·7	—	22·2	5·6	·11	12·4	46·9	42·2
	Do. Moocheepara ..	10,363	54	—	202	44	—	—	6	—	6	93	399	5·2	—	19·4	4·2	·57	8·9	38·5	30·9

Statement of Deaths from different causes during 1896—continued.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1891.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	9. All other Causes.	10. Total Deaths from all Causes.	11. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes.	From all Causes. For the Year.	Mean of previous 5 Years.
	Entally	33,147	142	1	600	183	—	—	10	—	10	353	1,289	4·2	·03	18·1	5·5	·33	10·6	38·8	37·0
	Campbell Hospital	—	77	2	110	502	3	—	3	—	6	354	1,150	—	—	—	—	—	—	—	—
	Baniapooker	23,020	40	1	423	92	—	—	4	—	4	223	783	1·7	·04	18·3	3·9	·17	9·6	34·0	33·3
	Ballygunge	22,831	107	3	326	126	—	—	6	—	6	352	920	4·6	·13	14·2	5·5	·26	15·4	40·2	43·3
	Bhowanipur	42,591	211	8	535	185	2	2	9	—	13	530	1,482	4·9	·18	12·5	4·3	·3	12·4	34·7	35·3
	General Hospital	—	7	—	3	2	—	—	—	—	—	21	33	—	—	—	—	—	—	—	—
	European Lunatic Asylum ..	—	—	—	1	—	—	—	—	—	—	2	3	—	—	—	—	—	—	—	—
	Alipur Lock Hospital	—	—	—	—	3	—	—	—	—	—	9	12	—	—	—	—	—	—	—	—
	Do. Jail Hospital	—	2	—	—	1	—	—	—	—	—	9	12	—	—	—	—	—	—	—	—
	Do. Police Hospital	—	—	—	1	3	—	—	2	—	2	9	15	—	—	—	—	—	—	—	—
	Do. Police Case Hospital ..	—	—	—	2	—	—	—	3	—	3	2	7	—	—	—	—	—	—	—	—
	Alipur	14,804	64	3	125	50	—	1	6	2	9	150	401	4·3	·2	8·4	3·3	·6	10·1	27·0	28·9
	Khidderpur	15,340	48	4	271	95	3	—	8	—	11	191	620	3·1	·26	17·6	6·1	·21	12·4	40·4	37·6
	Watgunge	26,836	134	6	317	124	—	2	8	—	10	153	744	4·9	·2	11·8	4·6	·3	5·7	27·6	23·9
	Total	2,12,998	1,051	29	3,472	1,514	8	5	69	2	84	2,691	8,841	4·8	·1	16·2	7·1	·3	12·6	41·5	39·9
	Canal	2,102	21	—	17	2	—	—	2	—	2	—	42	9·9	—	8·0	·9	·9	—	19·9	10·9
	Total of Suburban Calcutta ..	2,15,100	1,072	29	3,489	1,516	8	5	71	2	86	2,691	8,883	4·9	·1	16·2	7·0	·3	12·5	41·2	39·6
	Total of Municipal Calcutta ..	6,81,560	3,449	69	9,564	2,967	42	41	276	3	362	7,945	24,356	5·0	·1	14·0	4·3	·5	11·6	35·7	32·9

On the other hand, in comparison with the previous year, there was in 1896 an improvement in the general health of all the wards except six, namely, Sukeas' Street, Burrabazar, Waterloo Street and Hastings in the Town Proper, added part of Moocheepara in the canal area and Watgunge ward in the Suburbs.

As usual the mortality among females was higher than among males, the ratio being 41·7 and 32·5 respectively. The fall in mortality during 1896 from the previous year was due to a fall in the mortality among both males and females.

In comparison with the previous year there was a fall in the death-rate at all ages during the year 1896, the fall being particularly great under the age of five years. The figures are as follows :—

Year.	Under 1 year.	1 to 5 years.	5 to 10 years.	10 to 20 years.	20 to 40 years.	40 to 59 years.	60 years and upwards.	All ages.
1895	476·0	80·4	25·8	18·6	25·9	29·3	78·4	39·6
1896	435·4	50·4	22·3	17·1	24·2	28·5	74·0	35·7

The mortality of infants under one year of age, though below that of the previous year, was still very high. There were 4,265 deaths, being a mortality of 435·4 per 1,000 of the infant population. The mortality was much greater in the urban than in the suburban area of Calcutta, being 494·7 against 347·2 per 1,000 of infant population. It was greater in males than in females, and it was as usual greatest among the Mahomedans and least among the Christians.

The death-rates according to nationality during 1896 were lower than during 1895. The figures for 1896 are 25·4 for Christians, 36·6 for Hindus, 34·9 for Mahomedans and 45·6 for other classes against 30·9, 40·2, 39·0 and 59·0 respectively in the previous year.

The factor which contributed to the fall in general mortality in 1896 in comparison with the previous year was a considerable fall in fevers, bowel complaints and small-pox, as under the remaining causes there was an increase in mortality. This is shewn by the following figures :—

Year.	Fevers.	Small-pox.	Bowel complaints.	Cholera.	Other causes.	Total.
1895	11,345	2,220	3,269	2,099	8,098	27,031
1896	9,564	69	2,967	5,449	8,307	24,356

The decrease in the mortality from fevers, small-pox and bowel-complaints and increase in that from cholera and other causes took place alike in the town and in the suburban area.

Fevers.

The deaths from fevers in Calcutta during 1896 were fewer in comparison with those during 1895, but were more than the average of the previous five years. The total number of deaths recorded in Urban and Suburban Calcutta was 9,564, which is a decrease of 1,781 deaths from the number registered in 1895, but exceeds the mean of the five years from 1891 to 1895 by 791 deaths. The figures for the Town and Suburban areas and for the whole of Calcutta were :—

Period.	Town Area.		Suburban Area.		Total Calcutta.	
	Number.	Ratio.	Number.	Ratio.	Number.	Ratio.
Year 1896...	6,075	13·0	3,489	16·2	9,564	14·0
Year 1895...	6,831	14·6	4,514	20·9	11,345	16·6
Average of 5 years 1891–95 ...	5,320	11·4	3,453	16·0	8,773	12·9

From these figures it will be seen that in 1896 there were in the Old Town 756 and in the Suburbs 1,025 fewer deaths than in 1895, but that compared to the average of the five years from 1891–95 there were in the Old Town 755 and in the Suburbs 36 more deaths in 1896. So that though in comparison with 1895 the year 1896 was healthy as regards fevers, still when compared with the previous quinquennium the year under report appears unfavourable in respect to this class of diseases.

The number of deaths from fevers in Urban Calcutta during 1896 was, with the exception of that of 1895, the highest on record ; and if the year 1896, which was specially unhealthy in respect of fevers not only in Calcutta, but throughout the province of Bengal, be left out of consideration, it appears that ever since the year 1889 there has taken place a gradual but steady increase in the fever ratio in the old town.

Small-pox.

The mortality from small-pox during 1896 was very much less than during the previous year. There were only 69 deaths in 1896 against 2,220 deaths in 1895, and against an average of 539 deaths during the five years 1891 to 1895. Of these, 40 deaths occurred in Urban Calcutta and 29 in Suburban Calcutta, while the Port was free from the disease.

It was reported last year that the epidemic of small-pox which prevailed in the beginning of the year 1895 continued unabated up to April of that year. In May it began to decline and died out altogether in September. From October to December, 1895, there was not a single case of the disease among the residents of Calcutta, though cases were imported into the town by steamers arriving in Port and by the disease occurring among the newly arrived coolie recruits. In January 1896, a case of death from small-pox was reported from Beebibagan, Ward No. 19, Entally. The patient was an old woman of 60 years and was resident of the place. She was inoculated in her

infancy ; she died, and the Vaccination Department received information after her death on the 25th January 1896. As this was the first case amongst the residents of Calcutta after a long time, special enquiry was made by the Deputy Superintendent of Vaccination to trace the source of contagion, but no definite information on the subject was obtained. Her relatives said that she did not go out of town nor came in contact with any case of small-pox before her illness. On the 27th January a case of small-pox came to notice at Bokulbagan, Bhowanipur Ward. The patient was a Hindu male adult and came from Midnapur 8 days before his illness, there being cases of small-pox in his village at the time he left. He was vaccinated in his infancy. He was removed to hospital and got well. As vaccination and re-vaccination were vigorously carried out in both the above localities, no fresh cases occurred in them.

Of the 69 persons who died from small-pox during 1896, 17 were reported as vaccinated, 12 were reported as inoculated, and 40 were reported as unprotected, while none of the persons had had natural small-pox.

Cholera.

The mortality from cholera, during the year 1896, was very large in excess of the previous seven years. The number of deaths was 3,449 against 1,976, the septennial mean, giving a death-rate of 5·0 against 3·0 per 1,000 of the population. Of these, 2,377 deaths took place in Urban Calcutta, exceeding the mean of the previous ten years by 1,123, and 1,072 deaths occurred in Suburban Calcutta, exceeding the average of the previous seven years by 220. The figures for the two areas are as follows :—

—	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.
Old Town	1,741	1,198	1,734	1,079	963	1,553	1,257	596	1,118	1,302	2377
Suburbs	—	—	—	1,236	916	1,402	762	273	577	797	1,072
Total Calcutta ...	—	—	—	2,315	1,879	2,955	2,019	869	1,695	2,099	3,449

The mortality during 1896 was greatest in the added area of Shampooker Ward with a death-rate of 8·7, while it was lowest in Collinga Ward with a death-rate of 1·3. The average ratio of the town, namely, 5·0 per 1,000, was exceeded in eight of the Urban Wards, and in the added areas of all the extended wards. Next to the added area of Shampooker, the Wards Burtolla and Coomartooly suffered most from cholera during the year 1896.

The monthly mortality is shewn by the following figures :—

January	199	July	47
February	263	August	13
March	772	September	13
April	1,214	October	34
May	538	November	42
June...	197	December	117

These figures shew that the heaviest mortality, as in the previous year, was in the months of March, April and May. In fact, the cholera mortality during those three months amounted to nearly three-fourths of that of the whole year 1896. Towards the close of the first quarter of the year, it was observed that numbers of persons living in houses in the neighbourhood of certain public bathing-platforms and making use of them were being affected with cholera. This circumstance and the fact that the public bathing-platforms were supplied with unfiltered water drawn from the river Hooghly in the port of Calcutta made it desirable to have the water of the river and the public bathing-platforms examined bacteriologically. The results of such examination shewed that *comma bacilli* were in the river and bathing-platform waters, and that the highest percentage of instances in which *comma bacilli* were found to be present in the water was

practically synchronous with the greatest prevalence of cholera in the town, as illustrated by the following figures for the seven months from January to July:—

——	January.	February.	March.	April.	May.	June.	July.
Number of deaths from cholera ...	199	263	772	1,214	538	197	47
Water from Hooghly river—percentage of samples in which *commas* were found.	9·0	16·2	48·6	61·5	21·7	23·8	—
Water from bathing-platforms—percentage of samples in which *commas* were found.	—	—	53·0	57·4	4·1	—	—

The use of the public bathing-platforms, under the circumstances, was considered to be dangerous to the public health of the town; and it was, therefore, recommended that those platforms should be supplied with filtered water instead of unfiltered river water, and that to prevent the possibility of bathers contaminating the reservoirs at the platforms, such reservoirs should be in the form of closed cisterns provided with side-taps.

Dysentery and diarrhœa.

The mortality from dysentery and diarrhœa was lower in 1896 than in the previous year, but exceeded the average of the previous seven years. There were 2,967 deaths against 3,269 in 1895 and against 2,840, the mean of the seven years from 1889 to 1895. Of these, 1,451 deaths occurred in Urban Calcutta, exceeding all the corresponding figures of the preceding decade except 1894 and 1895, and 1,516 deaths took place in Suburban Calcutta, which is in excess of the corresponding figures of five of the previous seven years.

Other causes.

The mortality from all other causes in 1896 was higher than that of 1895, and also exceeded the mean of the previous seven years by 138. There were 8,307 deaths against 8,098 in 1895 and against 8,169, the mean of the preceding seven years, being a mortality of 12·1 against 11·9 and 12·0, respectively.

Vaccination.

Vaccination against small-pox was carried on vigorously during 1896; but owing to small-pox not being extensively prevalent in the town, as it had been during the previous year, the number of vaccinations performed fell much below the number of 1895. Total number vaccinated during the year 1896 amounted to 11,976 against 54,982 of the previous year. Of these, 9,450 were cases of primary vaccination and 2,526 of re-vaccination. The corresponding figures for the year 1895 were 15,184 and 39,798 respectively. This shews a decrease of 5,734 primary vaccinations and 37,272 re-vaccinations.

Of the 9,450 primary vaccinations, 8,585 or 90·8 per cent. were successful, 360 or 3·8 were unsuccessful, and in 459 or 4·8 per cent. the result could not be ascertained. In primary vaccinations the rate of success calculated on the ascertained cases was 95·4 per cent. Of the 2,526 re-vaccinations, 248 or 9·8 per cent. were successful, 1,026 or 40·5 per cent. were unsuccessful, 460 or 18·2 per cent were doubtful, and in 792 or 31·3 per cent. the result was not ascertained. The rate of success on ascertained cases in re-vaccinations was 14·3.

Of the total number vaccinated 6,557 were males and 5,419 females. According to nationality, 431 were Christians, 8,471 were Hindus, 2,969 were Mahomedans and 105 were other classes; and according to age 2,936 were under one year, 6,241 were of one year and under six years, and 2,799 were six years and upwards.

Vaccination is carried on in Calcutta under the provisions of the Compulsory Vaccination Act. The Registrars of Births issue notices to parents or guardians of children at the time of registrations to have the children vaccinated within one year from birth; and notice of the registration is at the same time sent to the Vaccination Department. When a child has been vaccinated and the result of the operation ascertained, a certificate shewing the result of vaccination is given to the child's parent and the duplicate of it is sent to the Ward Registrar, who thereupon makes an entry in his register to shew that the child has been vaccinated. The Registrars submit the Health Officer monthly statements of persons of whose children they do not receive certificates of successful vaccination within one year. By means of such statements prepared and submitted during 1896, it was found that 8,903 persons had failed to produce the statutory certificates of having had

their children vaccinated. These cases of default were enquired into by the Vaccination Department, with the result that 4,294 children were traced and vaccinated, 1,433 were found to have left town or changed abodes, 898 were not found at the addresses given, 671 had died, 1,147 were ill, 35 had natural small-pox, and the parents of 425 were left to be prosecuted. The actual numbers prosecuted during the year under this heading was 354, out of whom 11 were convicted.

Under the powers conferred on the vaccinators by the amended Act, house-to-house enquiry for unprotected children was daily made by the male and female vaccinators ; and where children over one year of age were found, notices were issued to their parents or guardians to have them vaccinated within 15 days. In this way 541 notices were issued during the year 1896. Many of the people served with notice got their children vaccinated within the prescribed time, but 291 had to be prosecuted. As in previous years, in localities like Jorabagan and Burrabazar, great difficulty was experienced in the cases of up-country people in obtaining the names of defaulting parents, and hence these could not be adequately dealt with by the law. In some cases where the names were obtained, the persons could not be identified ; and unless summonses were served personally, the Magistrates decline to make any order about vaccination. In consequence of these circumstances, vaccination is not making as much progress among these people as could be desired.

Besides the prosecutions noted above, prosecutions were also instituted against 147 persons for neglect to bring their vaccinated children for inspection. The total number of prosecutions under all heads by the Vaccination Department during 1896 amounted to 792 against 321 during the previous year. This increase was due to small-pox not being so prevalent in 1896 as it had been in 1895.

In Calcutta both the humanised and animal vaccines are in use. These were kept up by regular transmission, and used all the year round. The demand for animal *virus* is increasing yearly.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1896-97.

(Lieutenant-Colonel G. M. J. Moore, C.I.E., President.)

The New Drainage Scheme.—In addition to Rs. 200,000 granted last year the Government has contributed Rs. 150,000 in the current year. The Commissioners at their meeting held on the 3rd March 1896 appointed a committee to consider G. O. No. 2140 M., dated 21st December 1895, passing orders on the Drainage and Water-Supply Schemes of the City of Madras. The committee had a trial sewer with house connections laid in Parish Venkatachella Iyer Street, which worked very satisfactorily. Five meetings were held. The committee's report on the New Drainage was submitted to the Commissioners and approved of by them at their Special Meeting, held on the 18th of November 1896, and submitted to Government for sanction. The Government in its order No. 209 M., dated 12th February 1897, has approved of the scheme as proposed by the Commissioners and has sanctioned the appropriation of the provincial grant of Rs. 350,000 towards the construction of the Drainage of Mylapore on the house connection system and to lay pipe sewers with house connections along Ice House and Sydenham's Roads.

Twelve new drains were sanctioned during the year, viz., 2 in 1st Division, 1 in 2nd Division, 2 in 3rd Division, 1 in 4th Division, 1 in 5th Division, 3 in 7th Division and 2 in 8th Division. 10 of them have been completed, one drain in 2nd Division and another in the 8th Division are in progress.

Water-Supply.—A scheme for the improvement of the water-supply was prepared by the Engineer on the lines laid down in his Hydraulic Survey of 1895 and submitted to the Commissioners. The cost of this improvement amounts to $6\frac{3}{4}$ lacs. The northern line referred to in paragraph 90 of last year's report was completed and opened for use on the 2nd May 1896.

The quantity of water supplied to the City during 1896–97 was 450,768,294 c. ft. against 366,709,545 c. ft. last year. The following are the analyses of water taken (1) from the pipes at two places within the town (1st and 8th Divisions), (2) from Delivery Channel at Kilpauk, and (3) from Red Hills Lake from which it will be noticed that there is an appreciable improvement in the Red Hills Water.

	Water from Red Hills Lake 10 ft. from mouth of Tower pipe and 2 ft. below surface.	Water from No. 4, Cottage Delivery Channel before it enters the charcoal strainers at Kilpauk.	Water from Lamp post fountain in Quible Island St. Thomé High Road.	Water from the last wall two tap fountain at Ghouse Moiden Saib Street, 1st Division.
Total solids Grms. per litre	0·220	0·200	0·170	0·160
Volatile solids do. do.	0·100	0·080	0·060	0·080
Chlorine do. do.	0·030	0·030	0·030	0·028
Total hardness Clark's scale	1·575°	1·575°	1·400°	1·400°
Permanent hardness do. do.	0·350°	0·175°	0·175°	Trace.
Free ammonia Mlgrms. per litre	0·168	0·152	0·064	0·064
Albumenoid ammonia do. do.	0·272	0·240	0·224	0·240
Nitric acid do. do. (as ammonia)	0·390	0·150	0·030	0·150

Vaccination.

The total number of cases vaccinated during the year 1896-97 was 27,021, against 27,024 in 1895-96, showing a small decrease of 3 cases. Out of 27,021 cases vaccinated 16,028 were males and 10,993 females. 24,813 were successful, 1,044 unsuccessful, and 1,164 unknown. The unsuccessful and unknown cases were greater than in 1895-96 by 240 and 52 respectively, and this was due to the large number of revaccinations performed among prisoners of the jails, emigrant coolies, &c., who were released or embarked before the result of the operation could be inspected.

During the year 1896-97 1,779 cases were brought to the vaccine depôts to show the result of the operations, and in 21,510 cases the results were ascertained by the Divisional Vaccinators under bye-law 11 and certificates of success were granted to the parents and guardians after inspection at their own houses. These results were again verified by the Deputy Inspector and 4 Assistant Deputy Inspectors. The cases vaccinated in the Penitentiary, Civil Debtors' Jail, and Emigration Depôts (Natal and Mauritus) were inspected by the Deputy Inspector. Out of a total of 27,021 cases vaccinated more than 50 per cent. were inspected by these officers.

Excluding the unknown cases from the total vaccinated, the percentage of success in primary and revaccination was 95·96, against 96·89, showing a decrease of 0·93 per cent. due to the large number of revaccinations done during the year.

During the year vaccination was carried on in 9 depôts, in 7 of them tri-weekly, in one (Thousand Lights) bi-weekly, and in one (Egmore) weekly. 123 inoculated calves and 376 tubes of lymph were sent on application to vaccinate persons in their own houses. 147 calves were sent to the Penitentiary to vaccinate the prisoners and 45 calves to the Natal Emigration Depôt to vaccinate the coolies. Calves were inoculated in the Central Depôt, Chintadripet, and sent to the other depôts on the working days.

Out of 27,021 cases vaccinated 1,779 were Europeans, East Indians, and Native Christians, 2,509 Mahomedans, 22,731 Hindus, and 2 other castes. Of the total number vaccinated 19,193 were primary vaccination, against 18,877 in 1895-96, showing an increase of 316 cases. The percentage of success, in primary vaccination was 99·19, against 99·66 in 1895-96, showing a decrease of 0·47 per cent. There were 7,828 cases of revaccination with 87·11 per cent. of success, against 89·76 in 1895-96, showing a decrease of 2·65 per cent. The high percentage of success obtained in revaccination in Madras has repeatedly been commented on in Reviews of the Annual Report, and doubt thrown on the accuracy of the statistics. These results, however, though they compare very favourably with English ones, and especially with those of army revaccination, which are obtained from humanised lymph or from points, are not so good as those of some Continental towns where revaccination is done direct from the calf as is the practice in Madras. The following statement shows the results obtained both in primary and revaccination :—

Year.	Primary Vaccination.				Revaccination.			
	Successful.	Percentage.	Unsuccessful.	Unknown.	Successful.	Percentage.	Unsuccessful.	Unknown.
1895-96	18,598	99·66	62	217	6,510	89·76	742	895
1896-97	18,789	99·19	153	251	6,024	87·11	891	913

The number of infants vaccinated under one year of age during 1896-97 was 13,129 children, against 13,187 in 1895-96, showing a decrease of 58 cases, with a percentage of success of 99·36 against 99·74.

Vital statistics.

Births.—The births registered during the year 1896 numbered 18,684, exclusive of still-births, being 453 less than the previous year, but more than any other year in the decade. The ratio per 1,000 per annum calculated on the census population of 1891 was 41·2, and on an estimated population for 1896 38·6. The still-births numbered 504, being 2·7 still-births to 100 survivals. It is probable, judging from the general conditions prevailing in the town, that this figure is much too low, and that a number of still-births are not recorded. The male live-births numbered 9,555 and the female 9,129, the proportion being 104·6 to 100.

The Mahomedan birth-rate 46·8 per 1,000, was considerably above that of the Hindus 40·7, and of the Christians 39·1. As the Mahomedan death-rate is also above the average of the other castes, it is probable that the Mahomedan population is above the census enumeration.

Mortality.—The deaths registered during the year numbered 17,131, against 17,052 the previous year, the average for the decade being 17,744. The ratio per 1,000 calculated on the census population of 1891 was 37·8, but on the estimated population for 1896 35·4. The mortality was below the average of the previous ten years throughout the year, except in the months of May and June, when the mean temperature was the highest recorded since 1866. Though the mortality in Madras is generally comparatively low during the hot dry months, Chart I.* shows that there is an appreciable rise in May and that this rise was

* Not re-printed.

more marked than usual in 1896, when the temperature was abnormally high. This hot weather rise is most marked under fevers, but it is also apparent under dysentery and diarrhœa, both in the curve for 1896 and for the decade. From inquiries that have been made the somewhat paradoxical conclusion has been arrived at that the rise in fever mortality in the hottest part of the year is due to chill. This is attributed to people sleeping in the open, often on damp ground and without sufficient covering to protect them from the wind. This is quite sufficient to bring on an attack of fever in a malarial subject, and this conclusion is confirmed by the fact that many of these cases are complicated by pneumonia. It is not improbable that some deaths from insolation also occur amongst natives and are registered as "fever," but there is very little evidence on this head. The increased number of deaths from bowel complaints may also be in a large measure attributed to chill, but also in part to the large consumption of raw fruit, often fermented or unripe, by the poorer classes of the population at this time of the year. The bowel complaints at this time of year, when the ground is parched and dried up, are believed to be quite distinct from the epidemic diarrhœa and other bowel complaints specially connected with the soil, which usually cause a much greater rise in the mortality later in the year after the showers of the south-west monsoon have moistened the surface of the ground, producing favourable conditions for the organisms which flourish in a damp and polluted soil, and which decline after the heavy rains of the north-east monsoon have washed most of the filth into the sea and brought a fresh supply of water into the town storage tanks.

The Price of Food.—The price of food though high was fairly steady until near the end of the year, when a sudden rise occurred owing to the failure of the monsoon in many parts of the country and the consequent danger of famine. The normal given includes the years of scarcity since 1889 : if these were not included the divergence of the present prices from the normal would appear much greater. The prolonged dearness of the staple food grains cannot but exercise a potent influence on the mortality of the poorer classes, seeing that it is not counterbalanced by a proportionate rise in the wage of labour. The mortality has been high ever since the year 1889 when the scarcity commenced, though there has been no considerable epidemic during that period, except in 1891, when nearly 2,000 deaths were accounted for by cholera.

Meteorological Conditions.—From the Reports of the Government Astronomer it is apparent that the year was a decidedly abnormal one, the principal features being excessive temperature and deficient wind, accompanied by deficiency of rainfall during the first seven months and excess of rain in the last two months of the year. The highest shade temperature recorded was 112·4° on May 15th, the mean maximum for that month being 101·1°, and for June 99·9, both well above the average. North-easterly winds set in before the end of September, but very little rain fell till up to November 11th, after which nearly 50 inches fell in six weeks. The fall from October 15th to the end of the year was 52·9, against an average of 27·6 inches.

Mortality from different diseases.—A comparison of the relative mortality from different diseases in 1895 and 1896 shows that in the latter the small-pox mortality rose from 3 to 42, the highest number since 1891, that a marked rise occurred under measles, a slight one under dysentery and diarrhœa, the deaths from fever, cholera and "other causes" being lower. See also Appendix V., Table IV.

Statement of Mortality from the prevalent diseases in 1896 contrasted with that of 1895.

Years.	Small-pox.	Measles.	Fevers.	Dysentery and Diarrhœa.	Cholera.	Total.	Other Causes.	General Total.	Ratio per 1,000.
1895...	3	249	6,265	2,204	122	8,843	8,209	17,052	37·6
1896...	42	494	6,039	2,353	97	9,025	8,106	17,131	37·8
Average for 10 previous years.	30·1	405·2	5,269·0	2,959·7	475·6	9,139·6	8,604·7	17,744·3	39·2

Out of a total mortality of 17,131, 8,489 were males and 8,642 females, giving the proportion of 98·2 to 100. The number of deaths in the different castes was Europeans, East Indians and Native Christians 1,240, Hindus 13,631, Mahomedans 2,252 and others 8, giving the ratios per 1,000 31·2, 37·9, 42·5 and 13·4.

Small-pox.—During the year there was a considerable increase of small-pox, 194 cases with 42 deaths, giving a case mortality of 21·6 per cent. The incidence on the vaccinated and unvaccinated is shown in the following table :—

—	Attacks.	Deaths.	Fatality.
Unvaccinated	79	28	35·4
Said to be vaccinated but no marks ...	40	7	17·5
Vaccinated	72	7	9·7
Had previous attack of small-pox ...	3	—	—
Total ...	194	42	21·6

It is to be regretted that there are no statistics to show the number of vaccinated and unvaccinated persons in the town, for the unvaccinated population amongst whom 79 attacks occurred is a very small one compared with the vaccinated population as shown by the statistics of birth and infantile vaccination. The table however clearly shows the protective influence of a single vaccination so far as the mortality amongst those attacked is concerned, for the fatality amongst the unvaccinated was more than three and a half times as great as among the vaccinated. That 3 second attacks of small-pox occurred, none of which proved fatal, is in no way remarkable, for the protective influence of an attack in childhood diminishes in later life. There were apparently no cases among the revaccinated, and the supporters of vaccination do not claim that it affords a life-long protection. In this connection the following tabular statement is of interest, as it shows that amongst the unvaccinated small-pox is a disease of childhood, the victims either succumbing or becoming practically immune, whereas amongst the vaccinated but not revaccinated it is a disease of later life when the protective influence has diminished.

—	Total deaths.	Under 10 years.	10–20.	Over 20.
Unvaccinated... ...	28	24	2	2
Vaccinated	7	2	1	4

In this table the early incidence of fatal small-pox among the unvaccinated is well illustrated, but the number of fatal cases amongst the vaccinated is so small that any exceptional occurrence affects the proportions. If further evidence were available it would probably be found that the vaccinated cases that succumbed in childhood had only been operated on after contracting the disease, or could be explained in some other way, as statistics show that of vaccinated children only 0·5 per cent. contract small-pox under 10 years of age and of the 0·5 per cent. who contract the disease only 1 per cent. die. Out of the 75 unvaccinated who were attacked 45 were born in Madras and 9 were under the age of compulsory vaccination. The general inference is that had the town been less efficiently vaccinated the disease would have been much more widespread.

Cholera.—143 persons were attacked with cholera during the year. The deaths numbered 97 against 122 in the previous year, 0 in the 1st quarter, 3 in the 2nd, 56 in the 3rd and 38 in the 4th. The disease appears to have been imported in the 3rd quarter from Wandewash and Arcot into the 1st Division in which 45 out of the 56 fatal cases occurred.

Measles.—The epidemic wave of this disease which fell in 1894 when 190 deaths occurred appears to be on the rise again, the deaths in 1895 numbering 249 and in 1896 494. Under existing circumstances practically nothing can be done to check it. Isolation is at present out of the question and owing to the crowding of most houses in the town and the ignorance and indifference of the people in such matters it is almost impossible for any child to escape when once the disease gets into a house.

Fevers.—These diseases continue to exact a heavy toll on the population, accounting for 6,039 deaths in 1896 and a much larger number more or less incapacitated for work by sickness. The exact causes of the malarial fevers cannot be traced so long as the life history of their parasites outside the human body is unknown, but there is no doubt that

a polluted and water-logged soil favours these diseases, and when the sewerage of the town is effectively carried out the mortality may be expected to decrease. The 1st Division suffered the most severely with a death-rate of 16·7 from fevers alone, which is more than the death-rate of some towns from all causes. It is badly drained and contains a large number of poor paddy-boilers and weavers, who live crowded together in defiance of sanitary laws and easily succumb to any prevailing disease.

Bowel Complaints.—The deaths from dysentery and diarrhœa numbered 1,721 and 632 respectively against 1,536 and 668 in the previous year. The increased mortality from dysentery occurred in every Division except the 2nd, 3rd and 4th and was fairly spread over the year. Though there was an increase on the previous year the deaths from bowel complaints were well below the 10 years' average.

Plague Prevention.—Though Madras has fortunately remained free from Bubonic Plague yet precautionary measures against this disease have formed an important feature of the administration during the latter half of the year and the expenses incurred have made an appreciable increase in the expenditure.

In October a special staff consisting of 1 Sanitary Inspector, 2 Overseers and 2 Peons was appointed to inspect the passengers arriving from the North and ascertain their addresses for daily visitation by the Divisional Inspectors. To this staff a Hospital Assistant was subsequently added. After medical inspection was fully organised along the line at Arkonam and other stations and the passengers had their tickets marked with a special punch the work of the Perambore staff was limited to taking the addresses of such persons as had been passed at Arkonam, so as not unduly to delay the train. About the same time the Port Authorities were asked to inspect the crews and passengers of ships arriving from infected localities and take measures to prevent the importation of the disease into the town by that channel. The Post Master General was asked to disinfect the letters arriving from Bombay, which he declined to undertake. The erection of sheds at Perambore and Cassimode was decided on, vernacular notices about the plague and its prevention were circulated and a number of measures of a general character for improving the sanitation of the town were instituted.

Early in the year it was noticed that a large number of people were coming into Madras from Bombay and it was thought expedient to take more active measures for preventing the spread of the disease, if, as appeared by no means unlikely, it should be imported. The old Regimental Hospital and Lines in Old Jail Street on the borders of Black Town were lent by the Government of India and the Old Women and Children's Hospital, Egmore, now occupied in part as offices, was to be available after six hours' notice. A shed was erected in the compound of the latter for urgent use before the hospital could be handed over. Two bungalows were also rented at Perambore near the station for hospital purposes and a bullock cart was hired to attend daily at the station for ambulance work. Eight Equifex Spray Disinfectors of the wheelbarrow pattern and four Carter's covered ambulances were obtained from England. A limited staff, establishment and equipment, but sufficient to make a start with, were provided for the isolation hospitals, which were placed in charge of the District Surgeons, and the Surgeon General was asked to provide subordinate Medical Officers to take charge of them. The total hospital accommodation was then as given below, allowing about 100 square feet of ground area to each patient :—

Black Town, Native Infantry Hospital	..	...	26	patients.
,, The Armoury and other buildings	...	64	,,
Cassimode	2 sheds	60 ft. × 20 ft. each	...	20	,,
Krishnampet	,,	,,	...	...	20	,,
Perambore	,,	,,	...	...	20	,,
,,		bungalows	...	20	,,
			Total accommodation	170	patients.

The accommodation thus provided was capable of considerable expansion by the erections of sheds for which there was ample space available.

A few segregation sheds were erected as the nuclei of camps in the following places :—

Black Town	...	3 sheds with accommodation for	15	persons.
Vepery	...	3 ,, ,,	30	,,
Krishnampet	...	2 ,, ,,	18	,,
Perambore	...	3 ,, ,,	25	,,
Total ...	...	11 ,, ,,	88	,,

The Perambore sheds were for persons coming from infected localities who had no fixed addresses to go to.

On the representation of the Health Officer that the Municipal Act was absolutely inadequate for giving effect to the fundamental principles of preventive work, compulsory isolation, segregation and disinfection, an urgent application was made to Government for special powers to cope with the emergency, and communications on the subject took place between the Local and Supreme Governments. Shortly afterwards the Epidemic Diseases Act of 1897 was framed and passed, and Regulations under it for the City of Madras were drawn up and published in the *Fort St. George Gazette* of the 13th February 1897. These Regulations were translated into the vernaculars and widely circulated, in order that every citizen in the town should know what was required of him, and that people might be fully aware of the penalties they rendered themselves liable to for disobeying or contravening them. Thus with isolation hospitals, segregation sheds and regulations giving ample powers a much greater sense of security was felt and it was believed that any imported cases could be successfully isolated and dealt with. Under these Regulations the Municipal executive could enter any house and summarily abate a nuisance. Advantage was taken of this to eradicate a most objectionable form of nuisance consisting of an untrapped soil-pipe with no flushing tank connecting an upstair latrine with one on the ground floor, which had been introduced into a number of houses though never with the sanction of the Commissioners. Nearly 200 such tubes were removed by the Public Works Department at the instance of the Health Department.

About the time of the issue of the Plague Regulations the public of Madras was thrown into a state of perturbation by the announcement that the town had been made a pilgrim port and that a batch of pilgrims was about to be sent for embarkation. The Municipal Commissioners unanimously passed a Resolution protesting against this measure and requested that a public meeting of the citizens might be convened for the consideration of the matter. The Chamber of Commerce, Harbour Trust and other public bodies likewise protested. A public meeting was held in the Victoria Hall and a Resolution of emphatic protest was passed and telegraphed to the Secretary of State with the result that the obnoxious measure was eventually rescinded.

In order that the Health Officer might be free to devote his whole time to special work in the event of the plague appearing in the town, it was decided to appoint an Assistant Health Officer on Rs. 200 a month and Rs. 30 for horse allowance, and Mr. C. T. Mathew, L.R.C.P. & S., Edin., was appointed.

After the publication of the results of Mons. Haffkine's prophylactic inoculations in the Byculla Jail, it was suggested by the Health Officer that the measure should be introduced and that everybody who had been exposed to infection should be inoculated if he would consent to it. He also requested permission to go to Bombay to learn how to prepare the lymph and to study the immunisation of horses for curative serum and the general administration of one of the largest epidemics of modern times. The Commissioners, however, decided that he should not leave Madras, so syringes were indented for and the Bombay Plague Research Committee was asked to supply the prophylactic which was promised "when more urgent demands were satisfied," which apparently they had not been at the time of writing.

A number of false reports of plague were received but the correct diagnosis was in all cases easy, and up to the time of writing no true case in man or rat has been reported. No undue dependence, however, is placed on the fact that Madras is outside what is known as the "plague belt," being considerably below 20° N. Latitude, for it was found that the plague microbe remained healthy and produced strong colonies when cultivated on Agar under ordinary conditions in Madras.

ABSTRACT OF REPORT OF THE MUNICIPAL COMMISSIONER OF THE CITY OF BOMBAY FOR 1896-97.

(*Mr. P. C. H. Snow.*)

Special Drainage.—The unfinished works in progress in charge of the Special Drainage Engineer were the Colaba and Umarkhadi sewerage, Connaught Road and Sussex Road drainage and sewerage, Parel sewerage, Mazagon sewerage, Malabar Hill and Khambala Hill sewerage; while the following new works were commenced: House drainage connections (street portions), Colaba District; Fergusson Road and Chinchpokli sewerage (gravitation); a portion of, *i.e.*, 18″ pipe sewer, DeLisle Road; draining storm-water from the public roads around Mahaluxmi Dhobiwada; laying 9″ pipe drains for carriage of storm-water to the sea from the southern portion of Wodehouse Road. Several works were also sanctioned by the Corporation, but not commenced. **Public Works.**

Colaba Sewerage Works.—The works in pipe sewers were practically completed departmentally in February. The works connected with the air-compressing machinery, &c., were completed by 1st May, and all that remained to be done was the testing of the whole system of air-mains. The mains were finally tested, with satisfactory results at the end of the year, and the accounts of the works settled. The total cost, including erection, was Rs. 3,26,246-8-10. The other works connected with the Shone system in Colaba—engine-house, boiler-house, &c.—were practically completed by 1st October 1895. The expenditure on these was Rs. 80,908-14-2. The Umarkhadi sewerage was not completed until the end of May 1897. The expenditure on this work to the end of the year was Rs. 2,92,379-4-9. The Connaught Road and Sussex Road drainage and sewerage works were in the same position as last year. The Parel sewerage works were completed during the year, as were also the Mazagon sewerage works and the Malabar Hill and Khambala sewerage works (gravitation portion). The Shone system of sewerage worked uniformily well at Colaba, though it has not yet been possible to work up to full power, owing to the comparatively small number of houses connected and the small volume of sewage to be lifted.

Drainage.—The sewage pumping station at Love Grove worked satisfactorily, notwithstanding the excessive wear and tear to which the Worthington pumps are subjected. Although the rains of June and July were so excessive, the sewers were absolutely unaffected, all surplus discharging itself without difficulty through the Love Grove outfall.

House-connections with the drains.—The Corporation having decided, on the 18th June 1896, that the Municipality should bear the cost of constructing the street portions of the connections, and on the 3rd September sanctioned the advance of Rs. 100,000 for the purchase of materials, some advance was made, more especially after the outbreak of the plague. The scheme of converting the night-soil depôts at Bhangi Moholla and Haines Road into receiving depôts, with a view to lessening the qnantity of filth sent to Kamathipura, made but little progress on account of difficulties in obtaining labourers and of selecting a sight in Haines road.

Water Works—Tansa Lake.—The rainfall was 120·13 inches compared with 92·37 in 1895. The heaviest fall was on 29th July (8·30 inches) and there were excessive falls on the last ten days of that month. The lowest water-level was on the 15th June (395·14 T.H.D.), but after 30·34 inches had fallen the lake overflowed on the 5th July and the water continued to overflow until the 29th August. The quantity of surplus water passed over the waste weir was estimated at 27,700,000,000 gallons. The highest flood over the waste weir (1·80 feet) occurred on the 29th July. The approximate quantity drawn off into the duct from the lake was 8,569,000,000 gallons, of which 165,000,000 gallons were passed into Vehar Lake. The heavy falls of rain on 29th and 30th July flooded the duct line between Godavli and Balcomb, forming a continuous sheet of water for $3\frac{1}{4}$ miles. The embankment was seriously injured, and about 1,000 feet washed away from under the 48″ pipes destroying a portion and stopping the supply of water. The repairs took 18 days to complete, the staff working day and night in continuous heavy rain. In addition to this work, it was necessary during the year to make a temporary diversion of the 48″ main in order to make good a leak in the duct at the 44th mile, through which about 750,000 gallons daily were running to waste. This work was still in progress at the end of the year.

Vehar Lake and Dependent Works.—The rainfall was 109·81 inches, or 27 inches more than in 1895, and 25·97 inches more than the average of 1883-1890. The lake overflowed on the 25th July and continued to do so until the 28th August. The heaviest rainfall (9·78 inches) was on the 14th July. The lowest water level (252·70 T.H.D.) was on the 17th June. The storage on 31st October 1895 (11,010,000,000 gallons) was reduced by 31st May 1896 to 7,919,000,000. On 1st September following the storage had increased to 11,010,000,000. The daily loss during the dry season was 14·5 million gallons in addition to the water drawn from Tansa. Besides the water from Tansa, 1,800,000,000 gallons were received from the Tulsi Lake by overflow; the quantity of water passing over the waste weir was roughly estimated at 6,530,000,000 gallons.

Tulsi Lake.—The rainfall was 139·52 inches as compared with 100·40 in 1895, the heaviest fall (8·83 inches) being on the 14th July. The lake overflowed from the 23rd of July to the 27th August, to an estimated quantity of 1,800,000,000 gallons. On 31st October 1895 the storage was 2,136,000,000 gallons; on 31st May 1896 the quantity was reduced to 915,000,000. By 30th September 1896 it had increased to 2,156,000,000 The loss during the year amounted to 1,030,000,000 gallons, or 171,000,000 per month.

Pawai Lake.—No water was drawn from this lake, the pumping plant remaining in charge of the Assistant Engineer, Mechanical Branch. In February a further sum of Rs. 7,655-7-6 was paid into the Thana District Court on account of compensation for the land acquired for the duct line.

Bhandarwada Reservoir.—The old filters were worked till the beginning of December, when they were stopped for cleaning. Poor progress was made with the scheme for covering the storage basin and constructing filters over it. It was decided in June to substitute shingle for chips, and this led to the contractors removing the contracts, and the work will have to be completed, probably at increased cost, by other agencies. The expenditure incurred on the work during the year was Rs. 1,17,391.

Malabar Hill Reservoir.—The work of renewing the filtering materials was still in hand at the close of the year.

Distribution and Maintenance.—In connection with the plague, 1,180 house connections were cut off during the year and replaced by stand pipes in convenient situations. This, with the exodus of population reduced the consumption for some weeks, and the Tulsi supply was accordingly shut off from 25th January to 12th April 1897. There would have been still greater economy of water but for the large supply utilized for flushing purposes during the epidemic. The number of bursts during the year was 180 against 255 last year, and 313 in 1894-95. Apart from the work done on account of the plague, 230 services were cut off on account of demolition of buildings, non-payment of rates or the like, and 497 new connections granted. There were 2,047 meters in use on 31st March 1897, being an increase of 193. The consumption registered by meter aggregated a little under 1,259 million gallons.

Public Health.

The state of the public health during the year under review was very unsatisfactory. The mortality was 8,369 more than in the previous year. The total number of deaths from all causes amounted to 33,451, equal to a death-rate of 40·71 per 1,000 of population calculated on a population of 821,764 (Census of 1891). The average number of deaths for the previous five years amounted to 27,104, or a death-rate of 32·98 per 1,000 of population.

The number of deaths according to place of birth was as follows :—

Born in Bombay	13,637
Born elsewhere and unknown	19,814
Total	33,451

Cholera.—The number of deaths from cholera was 490, or 400 more than in the last year. The sections of greatest mortality were the Water Division, Girgaum, Dongri, Worli, Dhobi Talao and Parel. The highest death-rate by caste was amongst Lingayets, Hindu low-castes, Eurasians, Native Christians and Jews.

Small-Pox.—The deaths from small-pox were 701, or 431 more than in the last year. The rate of mortality was highest amongst Negro-Africans, Hindus of low-caste, Lingaets, Jains and Native Christians. The mortality was highest in 1st and 2nd Nagpada, Byculla, Tardeo, Worli, Girgaum, Dhobi Talao and Kumbharwada.

Measles.—There were 241 deaths from measles, or 303 less than the last year. Of these, 205 occurred in the first four years of life. Excluding the small community of Buddhists, the highest rate of mortality occurred amongst Lingayets, Jews, Hindu low-caste and Native Christians. The death-rate was highest in the districts of 1st and 2nd Nagpada, Tardeo, Kamatipura, Kharatalao and Dhobi Talao.

Fevers.—There were 8,776 deaths from fevers, or 2,372 more than in the previous year. The death-rate was highest in the districts of Kamathipura, Mandvi, Sewri, Kharatalao, Mazagon, Kumbharwada and Dongri. The greatest mortality was amongst Negro-Africans, Jains, Hindu low-caste, Lingayets, Mussalmans and Hindus of other castes.

Leprosy.—There were 54 deaths from leprosy, being 12 more than in the last year.

Bubonic Plague.—There were 1,936 deaths from bubonic plague during the year. A full report on the outbreak of this disease is under preparation for submission to Government, and will eventually be laid before the Corporation.

Births.—The number of births registered, exclusive of still-born, was 15,890, or 206 more than in the previous year. Of these, 8,267 were males and 7,623 females. Excluding Negro-Africans, the birth-rate was highest amongst Jews, Hindu low-caste, Parsees and Eurasians. The sections giving the highest birth-rate were Mahim, Sion, Kamathipura, Khetwadi, 2nd Nagpada, Tardeo, Fort Northern, Chukla and Parel.

ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1896.

(*Surgeon-Lieutenant-Colonel T. S. Weir.*)

In the Report for 1895, although there had been a reduction in the mortality, I took a gloomy view of the future that has, I regret, come too true. I wrote as follows in the opening portion of the Report :—

" Although there has been a very great improvement in the Public Health this year, " the mortality being 2,249 less then in the last year, yet I cannot hope for further " reduction in the mortality until the local insanitary causes that I have so frequently " described, and which I will once more describe so that there may be no responsibility " on me, are removed. 25,081 deaths were registered, being 2,249 less than in 1894. " Of this reduction in mortality, 820 deaths were from diseases of the respiratory system, " 594 from diseases of the digestive system, 336 from cholera, 261 from small-pox, 243 " from measles and 54 from fevers."

The two previous years, 1893 and 1894, were remarkable ; the meteorological phenomena and the incidence of diseases not only amongst human beings but amongst animals being abnormal. The abnormal meteorological states of these two years were accompanied by the prevalence of zymotic diseases amongst human beings and animals.

In the report for 1893 I wrote as follows :—" I have, after the very unfavourable record " of 1892, to report in this year a very great improvement in the public health, the " mortality being 3,376 less than in that year, but only 197 less than the average. This " is so far satisfactory, but it will not and cannot continue unless that more effective " means for carrying away the water brought into the City are provided."

And again in 1896 I wrote :—" Although in 1895 there have been 2,249 fewer deaths " than in 1894, I must repeat again what I wrote in 1893, that this improvement in " public health, so far as represented by 2,249 deaths, will not and cannot continue unless " that more general and therefore more effective means are constructed for carrying away " the water brought into the city. It is true that the reduction in mortality over the " previous year indicates that the general health of the city was so much better, but it " does not indicate, when the figures are carefully examined, that the local causes of " disease have been proportionately removed. The reduction is chiefly due to a lower " mortality from diseases whose prevalence I have always contended was due, not to local " conditions, but to general seasonal influences, although the mortality from each type of " disease was influenced and intensified by local conditions. The reduction in mortality " due to fevers is not considerable, being 54 less than in the last year and 273 below the " average. The chief reduction has been caused through a diminished mortality from " cholera, small-pox and measles, or, in other words, the three chief zymotic causes and " the group of diseases which accompany or are synchronous with them."

I classified the local causes unfavourable to the public health in the following order :—

I. Insufficient drainage—
- " (*a.*) Sewage.
- " (*b.*) Subsoil water.
- " (*c.*) Absence of connections between building and sewers."

II. Overcrowding.

III. Disposal of all the dry refuse on the Flats, Tardeo.

IV. The imperfect provision in the Municipal Act in regard to—
- (*a.*) Rebuilding of houses on old foundations without a " space for ventilation and " drainage being left on one side."
- (*b.*) The exclusion of the evidence of Municipal Officers " in regard to nuisance."

V. The obstruction of the sea-current around the Island by the " embankments at " Bandora and Coorla."

The important works accomplished or in progress during the year are :—
- (*a.*) The completion of arrangements for the removal of the refuse outside the island.
- (*b.*) The completion of house-connections in Lalwadi.

(*c.*) The completion of the Shone system in Colaba and the commencement of house-connections to the system.

(*d.*) The advancement of the drainage work in Nagpada and Umarkhadi and other portions of the city.

Before examining the statistics of mortality I must refer to the admirable regularity with which the sanitary work proceeded. It was the only work in Bombay not interrupted by the panic created by the plague. The removal of the refuse from buildings and from streets proceeded with the regularity and with even more than the vigour of ordinary years. The establishment deserves well of the city. Even the clerks, although they received no reward, did not follow the general example of those employed in private firms who deserted their duties.

Exclusive of still-born, 33,451 deaths equal to a mortality of 40·7 were registered, being 8,370 more than in the previous year and 8,267 more than the average. Of this excess mortality, nearly one-half occurred in the month of December. It will hereafter be shown that the excess mortality was distributed over 10 out of the 32 sections of the city, that in 13 sections the mortality was under 35 per 1,000, and that in four sections on the west side, Fanaswadi, Chaupati, Walkeshwar and Mahalakshmi, the death-rate fluctuated between 28·29 and 17·63 per 1,000.

The mortality amongst all classes except Europeans was higher than in any previous year since 1877 ; the mortality of the four chief classes varying from 53 per 1,000 amongst Mussulman to 19 per 1,000 amongst Europeans.

From the table printed hereafter showing the mortality according to place of birth, it will be observed that the number of deaths amongst persons born outside Bombay is as many as 5,945 in excess of the number born in Bombay. The mortality by place of birth, therefore, clearly indicates that there must have been during the year a great migration of people into Bombay.

TABLE shewing the NUMBER of DEATHS, exclusive of STILL-BORN, according to PLACE or BIRTH.

Months.	Bombay.	Elsewhere.	Unknown.	Total.
January	881	1,273	17	2,171
February	970	1,257	26	2,253
March	1,096	1,415	23	2,534
April	1,100	1,449	16	2,565
May	1,073	1,339	15	2,427
June	956	1,047	26	2,029
July	1,157	1,127	15	2,299
August	1,134	1,514	21	2,669
September ...	1,050	1,542	24	2,616
October	1,077	1,785	6	2,868
November... ...	1,002	1,876	11	2,889
December	2,141	3,958	32	6,131
Total	13,637	19,582	232	33,451

When the increase in the total mortality is studied closely, and examined especially in reference to the place of birth, it will be seen that the statistics demonstrate one of two things—either that the increase in the mortality in August was not due to Bubonic Plague, or that, if it was due to Bubonic Plague, the disease affected, out of the population, only the classes born outside of Bombay. Any conclusions drawn from the total excess of mortality in August over the average mortality of the previous five years without a careful examination into the causes and incidence of the excess, and without due consideration being given to the causes of that excess, are likely to be either illusory or incorrect. Moreover, when the mortality by months according to place of birth is examined, the surprising fact appears that, while the total mortality in August had increased by 370 over the number of deaths in July, the mortality amongst the people born in Bombay had decreased by 23, the increase, amounting to 387, in the mortality being amongst persons born outside of Bombay. Still more surprising is the fact that in September the mortality amongst persons born in Bombay continued to fall and decreased by 84, while in October it increased by only 27 ; but in November it again decreased, the most surprising fact of

all, by 75, while all these months from August to November the mortality was steadily increasing amongst the people born outside the City. It would, therefore appear that, either the people born outside of Bombay had brought the disease to Bombay or were more susceptible to the pestilence than the people born in Bombay.

Months.	Deaths.	
	Born in Bombay.	Born outside of Bombay.
July	1,157	1,127
August	1,134	1,514
September	1,050	1,542
October	1,077	1,785
November	1,002	1,876

These facts demonstrate that mortuary statistics cannot be treated as mere items in an account. I shall give another proof of the care necessary in drawing conclusions from mortuary statistics, although such demonstrations are familiar to every student of the subject. At the worst time during this epidemic, the mortality in one section (the Fort, South) never rose above 26·32 per 1,000. For the whole year 1896, the mortality in this same section (the Fort, South) was only 5·31, while in the City the general mortality was 40·70. If, therefore, mortuary statistics are to be received as ordinary items in a bill the chances of life are seven times greater in the Fort, South, than in the rest of the City. This reduces absolute conclusions drawn from mortuary statistics without any reference to the conditions influencing the mortality to an absurdity. We are, therefore, forced to accept one of three conclusions in regard to the increase of the mortality in August if the enhancement in the number of deaths was due to Plague—(i.) either the Plague was prevalent in a number of places outside Bombay, 2, or that it chiefly affected persons born outside of Bombay ; (ii.) or that there was an immigration into Bombay of people (*a*) either affected with Bubonic Plague, or (*b*) peculiarly susceptible to it.

The mortality by class is generally high, and, except amongst Europeans and Eurasians, higher than in the last year. Excluding the small communities liable to great fluctuations, the highest mortality has occurred amongst Jains (62·83), and Hindu low-castes (63·27). The high mortality amongst Jains has been greatly influenced by the occurrence of Bubonic Plague in this community. The poorer classes of that community live under very unfavourable sanitary conditions, in overcrowded, ill-ventilated rooms and shops. Their manner of living is very poor, and a large number are scorbutic. The population is also a very fluctuating one.

The mortality amongst Hindu low-castes is equal to 63·27 per 1,000, against 47·22 in the preceding year. Whenever abnormal conditions are prevalent, disease is rife, and mortality is high amongst Hindu low-castes. Whenever the seasons are unfavourable and prices of food are high, the Hindu low-castes suffer most. They are very poor, and may often be seen searching amongst refuse for food. Their dwellings are in the most crowded buildings of the most crowded localities. Several families live in one room—a domesticity generally unknown amongst other classes. They usually sleep on the floor on a thin sheet, and in the rainy season the ground on which they sleep is damp and mouldy, and nearly as damp as the street outside. There can be no hope for the reduction of the high mortality in this class until the Municipality builds buildings for them and gives relief and charity, and even when the Municipality builds model chawls for them, there will be an immigration of the out-caste population from the Mofussil into the city. The overcrowding even under municipal management will not be easily combated. It is difficult to help the poor, and, of all poor, the out-caste poor are the most difficult to help. Relief helps them but little, as other friends from a distance are attracted to share it. Dwellings for them should be erected. In these dwellings overcrowding cannot be prevented, but the effects of overcrowding may be lessened. Let the dwellings be so ventilated that overcrowding in them will cause little harm—that the poisonous vapors from human beings will be dissipated by free ventilation.

In all the chief classes the female mortality is much in excess of the male. The heaviest excess is amongst Jains, Brahmins, Mussulmans and Native Christians.

The mortality from the chief death causes is shown in the following table :—

Table shewing Number of Deaths and Death-rate from different Causes during 1896.

Cause of Death.	No. of Deaths.	Death-rate per 1,000.
Small-pox	701	·85
Measles	241	·29
Fevers	8,776	10·68
Cholera	490	·60
Phthisis	4,809	5·85
Bubonic Plague	1,936	2·36
Diseases of the Nervous System	2,272	2·76
Do. do. Respiratory System	5,334	6·49
Diarrhœa	1,613	1·96
Dysentery	737	·90
Accidents	487	·60
Other and unknown causes	6,055	7·37
Total	33,451	40·71

The mortality from the chief causes of death shows an increased fatality as compared with 1895 from—

Small-pox	431	Respiratory System	769
Fevers	2,372	Nervous System	228
Cholera	400	Diarrhœa	425
Phthisis	1,199	Dysentery	112

The increase in the mortality from fevers, independently of the appearance of Bubonic Plague, is equal to 10·68 per 1,000.

The mortality by age periods follows nearly the same incidence as in former years, giving a higher female than male mortality; while in the last year the excess was only 12·90, in this year the excess is 14·31. The mortality amongst males under 2 years of age was higher than amongst females at the same period of life. Over 2 years of age the mortality of females commenced to rise until, at the nubile period, it was nearly double the male rate. Compared with the previous year, an excess mortality was registered at all age periods. The excess was greatest between 10 and 30 years of age amongst males and females.

Small-pox.—701 deaths were registered from small-pox, being 431 more than in the last year. There was a recrudescence of small-pox. Excluding the small population of Negro-Africans, the highest mortality occurred amongst Hindu low-castes—1·59 per 1,000. The next highest mortality occurred amongst Lingaets, Jains, and Native Christians. The mortality by age periods follows the same incidence as in former years, the highest occurring under 4 years of age. The mortality from small-pox fell heaviest on females. This is the normal incidence of the mortality in this city.

The mortality by sections is very interesting and instructive, because it is seen to be highest in the most insanitary and ill-drained districts, viz., the Nagpadas and Byculla. The six sections of the highest mortality were :—

1st Nagpada	1·97	Tardeo	1·36
2nd do.	1·70	Worli	1·29
Byculla	1·37	Girgaum...	1·25

Measles.—Although small-pox was epidemic, the mortality from measles is 303 less than in the last year. 241 deaths were registered, against 544 in the preceding year. I ascribe the decrease in the mortality from this disease to the loss of life at early ages from the epidemic of Bubonic Plague. Children died from Bubonic Plague who would have succumbed to measles. In former years the incidence of mortality from measles and small-pox has followed the same course. This year the decrease in the mortality from measles during a period when the fatality from small-pox is greater is abnormal. The mortality by class is distributed more evenly than in former years. Excluding Lingaets, amongst whom 1 death occurred, and Jews, amongst whom 3 deaths occurred, the highest mortality occurred amongst Hindu low-castes. Mussulmans have the next highest mortality—·34 per 1,000.

Cholera.—490 deaths were registered. The mortality from cholera was comparatively high in 1896, but in the previous year an exceptionally small number of deaths occurred; only 90 were registered in that year. In all 623 cases were reported, 490 of which terminated fatally. The fatality by sex is very unequal, 82 per cent. of the cases amongst males and 72 per cent. of the cases amongst females having died.

The harbour had the highest mortality; 30 deaths on a population of 22,142, giving a death-rate of 1·35 per 1,000. Most of the cases in the harbour occurred amongst the population living in boats off the foreshore. This floating population, exposed to the inclemency of the weather, and the emanations from a tidal foreshore, and careless about the storage of their water-supply, are liable to attacks of cholera or choleraic diarrhœa. The second highest mortality occurred in Girgaum, 32 deaths on a population of 26,999, giving a death-rate of 1·18 per 1,000. The first case occurred on the 18th of February. The third highest mortality occurred in Dongri, 35 deaths on a population of 30,317, giving a death-rate of 1·15 per 1,000. Worli had the fourth highest mortality, 25 deaths on a population of 25,493, giving a death-rate of ·98 per 1,000. Dhobi Talao had the fifth highest mortality, 39 deaths on a population of 39,945, giving a death-rate of ·97 per 1,000. The first case occurred on the 30th January.

The highest mortality from cholera, excluding the small classes of populations, occurred amongst Hindu low-castes (0·97) and Native Christians (0·84)—two classes living under most unfavourable sanitary conditions—especially Hindu low-castes. I have so frequently described the unfavourable conditions amidst which Hindu low-castes live, I need not refer to them again.

The disease became prevalent in July, and was most generally diffused in August. In July 108 cases occurred, 82 of which terminated fatally; and in August 179, 137 of which ended fatally. I ascribe the prevalence of the disease in July to the abnormal season and to the development of cholera germs in the rainy season.

Fevers.—From fevers 8,776 deaths were registered, being 2,372 more than in the last year, and 2,117 more than the average. Of the deaths from fevers, 7,293 were referred to remittent fever, being 2,143 more than in the last year, and 1,897 above the average. 1,167 deaths were ascribed to simple continued fever, being 244 more than in the last year and 251 more than the average. 36 deaths were referred to enteric fever, being 1 more than in the last year and 12 more than the average. The total mortality from fever shows that the highest fatality occurred in Kamathipura, Mandvi, Sewri, Khara Talao, Mazagon, and Kumbharwada. The mortality in Sewri and Mazagon was enhanced by the occurrence of cases of Bubonic Plague in these sections. The death-rate on the small population of Sewri was equal to 2·14 per 1,000.

The mortality by classes is most interesting. The mortality of Europeans is 11 less than in 1895. Europeans and Bhatias are the only communities in which the mortality from fevers was lower than in the last year. Curiously, amongst the small community of Lingaets the mortality was the same. The highest death-rate occurred amongst Jains. The mortality amongst Hindu low-castes was 3,939 higher than in the mass of the Hindu population, and 3,085 higher than amongst Mussulman. The mortality in the Parsee community rose to only 6·74 per 1,000, against 6·63 in the last year. The enhancement in the mortality amongst Parsees represents an increase of five in the number of deaths. It is remarkable that, although the mortality of Mussulman is high, yet the loss of life is less than in 1871, 1872, 1877, 1878, 1879 and 1880.

Phthisis.—The mortality from phthisis by sex shows the enormous loss of female life caused through seclusion in crowded, ill-ventilated dwellings. The female mortality from phthisis (8·1) is more than double the male (4·11), and this great excess of mortality falls chiefly on Mussulman and high class Hindu females. In the same classes there is also an excess mortality from the same disease amongst males, indicating that the chief cause is to be sought for in districts of insanitary dwellings.

Plague.

In July I was seriously alarmed by an outbreak of foot-and-mouth disease on this side of India and in the city; it suddenly subsided in August. This sudden outbreak aroused my apprehensions of some epidemic appearing, and measures were taken to prepare for such a visitation. Special attention was given to the state of the sewers throughout the city and to conservancy measures. The drainage of the district of Mandvi, in which the disease first appeared in an epidemic form, had given cause for great anxiety for some time. In the beginning of September my attention was drawn to four deaths that had occurred on Mandvi Bunder. None of the cases had been attended by medical men, and death was preceded by enlargement of the glands around the neck, and from the descriptions given to me the cases seemed almost like diphtheria.

The first public notification of this disease was by Dr. Viegas in the end of September, and Dr. Viegas deserves much credit for the diagnosis of the case. I had no doubt even

before as to the nature of the disease, and from the first the disease was treated as Bubonic Plague. But I hoped that, as before when cases of fever with glandular enlargement occurred, that the disease would not spread, and I believe we would have been as successful as at other times had the rats not been infected and had the year not been abnormal and food scarce and dear. It is true that the microbe in the laboratory is not affected by atmospheric changes, but looking over the historical invasions of the disease, it is difficult to believe that it is not influenced by conditions that favour or control the development of all forms of life, and that it has not its seasons of growth and decay. However, we have seen that the predisposition to the disease is influenced by the state of bodily and mental health and that those who were depressed either in mind or body were most often attacked and most frequently succumbed. In passing a judgment on the difficulties of recognition in the first cases, it has to be remembered that fevers with glandular enlargements are not unknown in Bombay, and that even now, with the knowledge possessed of the disease in its varying forms, and notwithstanding the suspicion with which cases of fever are regarded, the recognition of some cases of Bubonic Plague is most difficult, even in an hospital.

Public alarm was aroused after the expression of opinion by Dr. Viegas that the disease was true Bubonic Plague. I reported that the cases were engaging our most serious and constant attention.

An early case was seen by Dr. Ranina in August in Bhandup Street. The patient was unconscious when first seen; temperature 103. According to the history, given by friends of the patient, fever had suddenly come on without any premonitory symptoms. There was great pain in the left hip, which led to the discovery of two large glands below Poupart's ligament. Drs. E. F. and C. F. Underwood had before this treated some suspicious cases with œdema over the glands of the neck. I had been consulted and seen four of the cases, and of two of these cases I have been shown a photograph.

The recognition of the disease was due to its prevalence in one portion of the city, amongst a class who believed in medical men. Had the disease been of the more infectious type, the pneumonic without external glandular enlargements, had it been a rapid form of fever with slight cough, the type assumed by the plague during the epidemic period, there can be little doubt its recognition would have been very difficult. Dr. Viegas, therefore, displayed much acumen in the diagnosis of the first case.

Three deaths that occurred in Walkeshwar from fever and pneumonia in the week ending the 25th August 1896 attracted my attention. Two of the deaths were of mendicants and the third of a servant. In this week the mortality in Walkeshwar section rose to 40 per thousand, from 12 per thousand in the preceding week, and it again fell in the following period.

The fair in Nassick commenced on the 13th August, and large numbers of pilgrims from Upper India had passed through Walkeshwar on their way to Nassick. There are reasons for thinking, if not believing, that the event of the pilgrimage to Nassick had an important influence on the propagation of the pestilence in this city. It has to be recollected, in forming an opinion as to the period when Bubonic Plague commenced in Bombay, that synchronously with the increase in the total mortality in this city, there was an increase of the mortality in a number of places close to Bombay. For instance, in the Thana Collectorate, the mortality rose from 4,384 in July to 5,286 in August. In Surat City the mortality rose to 2,024 in July, and decreased to 1,886 in August. In Kurrachee the mortality, which had been 1,929 in January, decreased to 702 in August, and rose to 906 in September.

In the presence of these facts, it is difficult to ascribe the excess and the increase in the total mortality of this city in August to Bubonic Plague. The increase in the mortality of the city was synchronous with an increase in the mortality in a number of places around Bombay. If it is held that the increase in Bombay was due to concealed cases of Bubonic Plague, because no better explanation of the increase occurs, it may just as reasonably be held that the increase in the mortality in other places was due to the same cause.

The first cases reported to me seemed, from the description of the symptoms given by the friends, to be cases of diphtheria, and I may not pass over this opportunity of referring to other cases at a later period of a similar character and obscure type. Six cases, two of them of a very distressing type, were found in Mazagon on the 24th of February. They were a group of cases in one family that had been brought into Bombay from Thana. One of the family, a child, had died in the train, on the way to Bombay, from Bubonic Plague. Three of the cases had glandular enlargements around the neck. One of these, a female, had enormous œdema of the neck extending down below the clavicles on to the chest and into the axillæ.

There was great pressure on the trachea and gasping respiration. She died on the evening of the day I saw her. There was another case with enlargement over the parotid and submaxillary glands. This was a milder case and doing well. Undoubtedly, the cases were of plague, and yet bacteriologically the results of examinations obtained by two different observers were negative. Professor Bitter who saw the cases had no doubt as to the type of the disease and that it was Bubonic Plague. They were not dissimilar to the first cases in Mandvi described to me.

The time has not yet arrived to announce the date when the first case occurred in Bombay. We must wait till the experiences of medical men throughout India have been obtained. It is not improbable that when the disease has been more generally recognized and its different types distinguished—for even now some cases are most difficult of recognition during life—it will be found that cases of a disease not dissimilar in symptoms have occurred in periods not very remote, not only in Bombay, but in other parts of India. I have no doubt that the cases observed by Dr. Simpson in Calcutta were of Bubonic Plague.

In the Himalayan ranges and lower hills on the Indian frontier, the disease is endemic, and we have to remember that Bombay is in free communication with countries beyond India where the disease is endemic.

The following case treated in the Parel Hospital is of great interest, showing as it does the varying forms of the disease and how difficult these forms may at times be of recognition. Dr. Thomson writes :—" The German Scientific Plague Commission experts " found plague bacilli on three different days in the blood cultures, and the day before " death and at the *post-mortem* not a single plague bacillus could be demonstrated in the " blood of any of the organs. Their conviction was that the patient died from the severe " complication, and had his vitality been greater and no complication supervened, he would " certainly not have died of plague, all the bacilli being destroyed."

A very curious case was sent by me from Dongri to Grant Road Hospital. Some medical men present had doubts about the case. The case was of a boy suffering from mycetoma of the foot. He had no indications of Bubonic Plague, except a peculiar look about the face and a peculiar tongue covered with a white fur. The case was kept under observation. The Russian Scientific Mission made a culture from the foot and obtained plague bacilli. This case afterwards developed an abscess in the liver.

The desire of the people, when ill, to go somewhere, and especially to their country home, even when their homes are far away, was very remarkable. The same disposition I noticed in Europeans, when ill. In the course of the disease it is very remarkable the distance and number of the places to which numbers of wealthy and even poor people fled.

In the beginning we telegraphed to Lanowlee and other places giving information of people who had escaped from Bombay, and where they were supposed to be going. The first imported case noticed in Lanowlee was reported on the 14th of October. The first indigenous case in Lanowlee occurred on the 17th of April ; but it occurred a little outside the bazaar, and there was, as far as I could ascertain, no history and no suspicion of any recent case of importation.

The period of incubation in some cases appeared to be under two days.

Two very interesting cases were imported by sea. One case, a steward, who came direct in a steamer from Suez, landed, suffering from slight fever ; but afterwards the characteristic symptoms of Bubonic Plague appeared with enlargement of the glands on the right side of the neck. Temperature 105 ; respirations 55 at time of admission. The steamer had touched at no places between Suez and Bombay.

Two other cases I may refer to, both of which came from Assam to Calcutta and from Calcutta to Bombay by sea. The day after arriving in Bombay, they suffered from slight fever, and made up their minds to leave Bombay and go to Kurrachee. With this intention they took passages for Kurrachee and went on board the steamer. There they were examined, detained and sent to the Segregation Hospital in Reay Road. Both cases were afterwards removed to hospital.

In removing patients to hospital I saw many appalling instances of the rapidity of the disease and the suddenness of death. On one occasion I saw an opulent Hindoo in a crowded house, and I was asked whether he should be removed or not. I directed that he should be removed, but we did not tell the patient nor his friends. We thought we had better not till the ambulance came. I left for office, and before half an hour had passed and before the ambulance had come, I was told that he was dead. One felt thankful and had a feeling of relief that the sufferer had not been told that he would be removed to hospital and his last moments disturbed by fright.

The desire to wander—the delirium of the disease—is very strange and pathetic. A patient, with a temperature of over 100°, suddenly becomes influenced by this desire to wander. He leaves his house, and if he is wealthy, he drives to a railway station and tries to proceed to some place, and he cannot tell you why. I noticed this desire to wander in all classes, and it often precedes high fever and delirium.

As the epidemic proceeded people became alarmed in regard to the danger indicated by dead rats, and they commenced to write to us in the following strain, as this letter will show :—" As some dead rats are found in the house I am living in, and as I am afraid " that it is infected with the plague, I want to vacate it temporarily and live in some " sheds ;" and the letter finishes with a request to occupy some municipal land. In August there was a great increase in the mortality amongst cattle and sheep and goats. It will be observed from the table hereafter printed that there had been from July an increase in the number of dead animals removed. The small increase in the number of dead cats removed in July and August shown in the table will be observed. It will be observed that the mortality amongst horses decreased in these months.

Statement showing the Number of Dead Animals removed from May to September 1896.

Months.	Bullocks.	Buffaloes.	Cows.	Horses.	Calves.	Goats and Sheep.	Dogs.	Cats.	Other Animals.	Total.
May	34	28	17	59	410	66	325	36	9	984
June	42	30	15	51	456	67	282	34	13	990
July	38	31	11	29	712	88	184	41	19	1,153
August	47	30	22	23	870	117	224	44	18	1,395
September	48	33	16	31	733	104	206	36	9	1,216
	209	152	81	193	3,181	442	1,221	191	68	5,738

The people did not, and could not, believe that the disease was as dangerous as we pronounced it to be. They had been demoralized by the successes we had in dealing with infectious diseases. They expected that the new disease would be stopped as readily as cholera had in all former years been eradicated by our measures. The people here had no conception of the sacrifices willingly made in European cities for the prevention and suppression of infectious diseases.

Such a pass had we come to, that picking up a few sick pigeons caused excitement, and, nearly led to a riot, and peaceful Banniahs, for 10 sick pigeons, threatened to raze the city. Even the position of a dustbin was considered of public importance. All our attempts to kill or catch rats were opposed or threatened. It is difficult to persuade a people, with more regard for the lives of animals than for the safety of their own kindred, that it was right to kill or to capture animals either to stay the pestilence or to obtain a knowledge of the disease. I had hopes in September that a microbe, which Professor Hankin had a supply of, would when cultivated develop and destroy rats, but on being tried it was inert. We offered rewards for all dead rats found, and very general measures were taken to destroy rats and burn the dead ones. But soon the rats became scarce, or were not to be seen outside. While the rats were sick in Mandvi, the mice were unaffected, and in our office in that locality the mice, when rats could not be found in the district, were numerous and lively. So bitter was the opposition to the capture of rats that monstrous stories were invented of our officers throwing live rats on the fires, as if to give pleasure to men tired and weary, and knowing the danger of handling rats, doing what they need not do even if a sense of humanity did not forbid them. And so events proceeded, we were opposed on all sides, whether in the treatment of buildings, in the treatment of human beings, or in the treatment of animals. People whom we found sitting up and whom we begged to lie down, even before we left their doors, were again sitting up, and more than once before we left the building, we heard that they were dead ; as Dr. R. often said to me : " It is useless to give advice to the people." We had to deal with some people more careful of the lives of animals than of their own. We had to carry out measures opposed to the interests, the customs, and the dearest feelings of

some classes of the people :—1. To clean out houses when the people themselves would not either clean the houses or employ others to do it. 2. To remove the sick. 3. To burn or expose to the sun all articles likely to have been infected.

In the large buildings in Mandvi the tenants would not employ people to clean down the passages and spaces outside the rooms, as they said it was the duty of the landlords. They maintained that the landlords should do it, and we could not find the landlords. The Jains and others are a people very tenacious of their rights. People in these and other crowded buildings complained of everything outside and of nothing inside their dwellings ; to them a few leaves in a street or gully were a serious object of complaint, but the nuisances outside their own rooms and inside their houses they preferred to bear with rather than save the landlords the trouble of doing what they thought the landlords ought to do. It is a most serious defect in the law that there is no provision to compel landlords to employ an establishment to keep their houses clean.

On many occasions the ambulance vans were damaged even after the Plague Committee had been formed. One of my first duties in March was to go down to Falkland Road, as it had been telephoned to us that a large crowd had collected and stoned the ambulance van. On the way I sent Assistant Surgeon Pettigrew to bring up a detachment of soldiers from the Northbrook Garden. I found a very large crowd in the street, every lane being filled, and the soldiers had to drive the crowd back. Whether at the railway stations or in the city, nearly every hand was against the Municipal Officers, simply because people did not, and would not, understand that the disease was contagious. To show what strange customs prevail, I need only refer to the defence put forward in the Police Court, in a case where cows were kept on the ground-floor of a dwelling. The plea urged was that the cows were kept for religious purposes, the ladies of the household having to worship them in the morning. I believe the plea was true.

On the 29th of September a Committee was appointed by Government. The Committee had their first meeting on the 31st of September, and resolved that the Municipal Commissioner be requested to obtain sanction from Government to carry out, as far as practicable, the sanitary measures recommended by the Surgeon-General. The second meeting was held on the 9th of October, at which it was resolved that all cases recognized as Bubonic Fever should be carefully isolated or segregated in the best manner possible. Some discussion took place, and Dr. Viegas, after voting for the motion, said, that he had done so on the understanding that those cases which could be isolated or segregated in their own houses should not be removed.

On the 29th of September the Surgeon-General wrote to Government as follows :—

> " Firstly, then, I should suggest an immediate increase of the sanitary staff of the Municipality, " both in Medical Officers who may be chosen from local practitioners willing to serve, " and subordinates, with the special object of paying sanitary attention to quarters of the " city not yet known to be infected. I may here mention that two cases are said to have " occurred in the Fort last evening."

From the very beginning, I may mention, the measures suggested by the Surgeon-General had, as far as practicable, been carried out. The system of treating buildings in which cases occurred was the same all through the epidemic. There is no other system which could have been adopted.

One of the first orders I issued was, that every suspicious case was to be treated, for all practical purposes, as one of Bubonic Plague.

On the 6th of October, the Commissioner issued the following Notification :—

> " WHEREAS a dangerous disease, namely, Bubonic Fever, has broken out in certain parts of the " City of Bombay, and the Municipal Commissioner is of opinion that the ordinary " provisions of the City of Bombay Municipal Act, 1888, or of any other laws in force in " Bombay are insufficient for the purpose of effectually preventing the spread of such " disease, Public Notice is hereby given that, with the sanction of the Government, and " pursuant to the provisions of Section 434 of the said Act, the Commissioner hereby " prescribes the following temporary regulations to be observed by the public and all " persons concerned. And further that the Commissioner will, if necessary, take such " special measures as are hereby indicated for carrying into effect the objects of the said " regulations :—1. In extension of the provisions of Sections 422, 425 and 427 of the " said Act, it is hereby prescribed that every person having the control or charge of any " building, or part of a building shall, on demand by the Commissioner or any officer to " whom the powers, duties or functions of the Commissioner under those sections may " have been or may be delegated, immediately cause such building or part of a building " to be opened, and shall permit the Commissioner or any such officer as aforesaid to " cleanse and disinfect the same, to cause the removal for disinfection or destruction of " any grain, bedding, or clothing, or of any other goods or articles found therein.
>
> " For the purpose of carrying into effect the objects aforesaid, the Commissioner, or any such " officer as aforesaid, will, whenever he shall deem it necessary so to do, break open and " forcibly enter any such building or part of a building, and, without previous notice to " the owner or occupier thereof, will cleanse and disinfect the same, and direct or cause

" the forcible removal and disinfection or destruction of any grain, bedding, clothing, " goods, or articles as aforesaid. 2. In extension of the provisions of Section 424 of the " said Act, it is hereby prescribed that any person suffering from Bubonic Fever, " wheresoever found and whether provided with proper lodging or accommodation or not, " or whether lodged in a building occupied by more than one family or not, shall, on a " certificate signed by the Executive Health Officer or by any duly qualified medical " practitioner that such person is suffering from the said disease, be liable to be removed " to any hospital or place at which patients suffering from the said disease are received " for medical treatment. For the purpose of carrying into effect the objects of this " regulation, the Commissioner or any officer to whom the powers, duties, or functions of " the Commissioner under Section 424 have been or may be delegated, or any Police " Officer empowered by the Commissioner in this behalf, will, whenever he shall deem " it necessary so to do, cause any person in respect of whom such certificate as aforesaid " has been made to be removed to any such hospital or place as aforesaid. 3. Every " house in which any case of the aforesaid disease exists or has existed shall, for so long " as the Commissioner shall deem necessary, be isolated in accordance with such orders " as the Commissioner may in each case prescribe and every occupant of such house and " other person who may be therein, or who may resort or desire to obtain access thereto, " shall obey any order which he may receive from the Commissioner or any Municipal or " Police Officer empowered by the Commissioner in that behalf, prohibiting ingress to or " egress from such house. For the purpose of carrying into effect the objects of this " regulation, the Commissioner or any such Municipal or Police Officer as aforesaid will, " if necessary, forcibly prevent persons from entering or leaving such house."

The notification of the Municipal Commissioner of the 6th of October 1896 in regard to the regulations to be observed in the treatment of buildings where cases occurred, and of persons suffering from the disease, was received with loud denunciations, and answered by petitions protesting against its terms, and many classes of the population announced that they would leave the city, and undoubtedly they intended to do so. It was stated that the hospitals were places of torture and places intended to provide material for experiments. The Officers of the Health Department were charged with a brutal pleasure in dragging the sick from their homes and in killing them, and it was stated that our Sovereign Lady the Queen had demanded 500 livers of the people of Bombay to appease the wrath aroused at the insult offered to her statue. Men have said to me, " You think we are like mad dogs, and you want to kill us, as " if we were."

There were men, and aged men, from whom sage counsel and words of wisdom might have been expected, but who kept calling out, " Lost, lost ! " and crying to us, " Burn, burn." As people in a panic flying from danger unknown, so some in mad panic fled, they knew not whither. A fear seemed to have taken possession of the minds of some when all fear ought to have disappeared. Many fled from their own fears, and in flying frightened others. Some who might have been expected to be calm, if they did not remain silent, kept calling to others to fly and save themselves. They wantonly called on the Health Officer to burn down districts as if I had not chemicals to do, with not less certainty, what fire does.

A petition from a number of influential citizens was sent to the Commissioner on the 14th of October. It was stated that, hospital life being unknown amongst the people, the patient himself was most averse to being removed and deprived of the care and comforts he could count on in his family, and his removal was looked on, both by himself and his attendants, as certain death. In this petition it is stated that, if the regulations continued to be enforced, a much larger number of inhabitants would fly from Bombay. The petitioners demanded that the regulations should be carried out by all Municipal subordinates with care, judgment, and tact ; that friends and relatives did not like to part with their sick nor see them taken to hospital " recklessly " ; that " house measures " should not be entrusted to young and raw European and Eurasian lads ; otherwise there would be more discontent and panic, and so on.

It should be understood that the sick who were removed to hospital were not separated from their friends, as alleged. In the Arthur Road Hospital one or two friends were always allowed to attend upon the patients, and visitors were admitted into the hospital at all hours. In one case the Medical Officer wrote that a Hindu female was admitted with ornaments of the value of a couple of hundred rupees ; that the next day her relatives came to see her and took charge of the ornaments, and then went away, but never afterwards returned. The woman died, and her body had to be removed by the Municipal Authorities.

On the 15th of October, a Committee was appointed to enquire into the nature and history of the disease.

On the 20th of October, 500 mill-hands assembled on the road outside the Arthur Road Hospital and threatened to wreck the building and carry off the patients. On the

29th, some 900 or 1,000 mill-hands collected and rushed into the compound of the hospital and threw stones at the building, chasing the staff into the offices and inside the hospital. Even some of the patients were struck by the missiles and all were greatly terrified. The news of the disturbance was at once telephoned to the Police who promptly appeared on the scene. In this disturbance one of the ambulance vans was smashed, and the roof of the hospital damaged.

The mill-hands were a source of much anxiety. Yet they had been very considerately dealt with. Whenever a case had occurred in mill buildings occupied by mill-hands, or in other buildings, so long as it was fairly isolated, it was left alone. We had also agreed that if the mill-hands gave information of cases and isolated them, they would not be removed to hospital.

On the 30th October, the Municipal Commissioner issued the following notification, and I think it will be generally admitted that the terms of the notification were most reasonable and considerate :—

"WHEREAS the Municipal Commissioner is informed that great alarm has been caused to the "public by the Notification recently issued under Section 434 of the Municipal Act, and "whereas the objects of that Notification have been misunderstood, inasmuch as the powers "under it were obtained principally to meet the case of a large increase of Bubonic "Plague. The public are now hereby informed that no cases where proper segregation "and treatment can be carried out on the premises will be removed to the Arthur Road "Hospital, and in such cases as require removal no action will be taken except upon the "certificate of a qualified medical practitioner employed by the Health Department. "The Executive Health Officer has been instructed accordingly and the Commissioner "of Police informed."

On the 11th of December, a Committee, composed of members of different communities, was formed. At a meeting held on the 22nd of December, Mr. Hankin put his views before the Committee, and advocated the removal of the healthy from infected dwellings. The Committee approved of this recommendation, and appointed a Sub-Committee to ask the Municipal Commissioner to form camps where the healthy could reside. Previous to this the Commissioner had constant conferences with representatives of different communities. The Committee issued the following notice :—

"HOW TO AVOID THE PLAGUE.

"At a meeting of several influential citizens held on the 11th of December 1896, the gentlemen "whose names are given below, representing the different communities of this city, "were appointed to form a Committee to consider, amongst other things, the steps best "calculated to prevent the spread of the plague and to recommend to the people at "large the precautionary measures to be adopted to avoid the disease. The Committee "have been able, with the assistance of the best expert opinion, to prepare the following "rules which embody recommendations which should be carefully observed, and, in "order that these rules may be widely known to the public, the Committee have decided "to publish and circulate them in different languages in the form of handbills over their "signatures. The Committee hope that it will be clearly understood that the instructions "and recommendations contained in the following rules emanate from the Committee. "The names of the members of the Committee will, it is to be hoped, be a sufficient "guarantee to the different communities of this city that the recommendations made are "in the best interests of the people themselves and of the health of the city. In view "of the present dangerous state of public health, the necessity of keeping houses in the "town, and especially those in crowded parts, clean and free from bad smells, and of "following the instructions contained in the rules, cannot be too greatly impressed upon "the people. Light and air ought to be allowed to enter houses freely, and wherever "the means of ventilation are not sufficient it is extremely desirable that steps should "be taken to provide better ventilation, so that sunlight and fresh air may enter the "rooms. The Committee earnestly hope that the advice given by them, coming as it "does from the representative men of the different communities, will be cheerfully "accepted and acted upon.

In the rules the Committee gave excellent advice. They urged the people to inform the Municipality of all cases, and to leave infected houses. The danger of wet or damp places inside dwellings was pointed out. They advised the people to be careful of abrasions or sores.

They dwelt on the necessity of burning all articles that had come in contact with the sick.

Dr. BALCHANDRA KRISHNA BHATAVADEKAR.
Mr. K. N. KABRAJI.
Dr. ISMAEL JAN MAHOMED.
Professor O. V. MULLER.
Dr. A. D. MODY.
Dr. N. N. KATRAK.
} *Honorary Secretaries.*"

The Committee pledged themselves to use their influence to reconcile the people to the use of the segregation camps, but it was not possible to persuade the people and especially the poor at this time to enter either camps or hospitals.

The Commissioner put up excellent camps underneath bright coloured awnings, capable of accommodating some 1,500 people, one was erected in the Northbrook Gardens, and the other near Connaught Road, but people would not enter them although they were most attractive.

Many ingenious calculations have been made as to the decrease in the population during the epidemic, but conclusions based on an uncertain foundation, however much they may interest an enquirer in leisure moments, can scarcely deceive a student of statistics. The calculations made of the decrease in the population are all based on the population of 1891, and not on the numbers of the people at the time of the appearance of the epidemic. Speculation based on inferences drawn from calculations of the decrease in the population must be illusory if not vain. The fundamental fact—the increase of population between 1891–97—is not known. Conjectures as to the decrease in the population must be regarded with the interest which attaches to all speculation on a subject of so much importance and of so much interest to many of us. All that is known is that a certain number of people departed from the City by certain ways, by railways and by steamers, and that a certain number entered the City by the same ways. This information, although enough to give a vague or uncertain knowledge of the fluctuations of population, is not sufficient to afford an estimate of the numbers to which the population of the city was reduced. And, moreover, it is too often forgotten in these speculations that the rate of mortality greatly varies in different classes. While the class amongst whom the mortality is lowest, and whom we wished to remain, left the City in numbers ; the class—the poor, the out-caste, and the destitute from famine-stricken districts—whom we did not wish to remain, not only did not fly the city, but increased in numbers. The poor were always with us and increasing in numbers and in destitution.

I may quote the opinion of Mr. Baldwin Latham on the reduction of population between November and January, as he is an undoubted authority on mortuary statistics. He writes that the population of Bombay had been "reduced from 806,144 in 1891 to 723,336 " in the period of September and January last."

I believe that in this report for the first time statistics have been compiled and published, exhibiting the spread and marking the fatal path of the disease in buildings, through different classes of people and at different age periods.

Up to the end of the year, 2,544 cases of Bubonic Plague were reported. 1,936 of the cases ended fatally, giving a mortality of 76·10 per cent. The progress of the disease by months, as seen in the number of cases reported, indicates that not nearly so many cases escaped detection in the first months as was generally believed. In October the number of cases increased to 406, while in November, when the fear of removal to hospital had decreased, the number of cases fell to 339, but the fatality amongst those attacked rose, and in December, after the development of the epidemic, the percentage of deaths to cases it will be noted decreased. This shows that not many cases escaped detection.

The incidence of the mortality does not denote any great concealment of cases. It rather indicates the vigilance that must have been observed in examining buildings and in obtaining information.

TABLE SHOWING THE NUMBER OF ATTACKS AND DEATHS FROM BUBONIC PLAGUE IN 1896.

Months.	No. of Attacks.	No. of Deaths.	Percentage.
September	135	79	58·51
October	406	313	77·09
November	339	273	80·53
December	1,664	1,271	76·38
Total	2,544	1,936	76·10

In the crowded buildings in Mandvi in which the disease first appeared, we had over 100 people in many buildings and as many as 600 people in one building, one family living their life in one room, opening on to a common passage in which the grain was ground, and at one end of which was the water-pipe under which the clothes were washed, splashing the walls and floors around. We take for explanation one building in Clive Road. There are 116 rooms, and say there are 4 persons to each room ; it gives nearly 500 people to the house, and underneath this mass of people, densely pressed in one building, with the foulness that must come from human beings, are 3 godowns and

shops and yet this is not by any means the most crowded and densely populated dwelling in the city. No one can look at the size of the buildings and the number of rooms in each building in this locality as shown in the statement without having a feeling of astonishment that the mortality has been so low. They are most thrifty people, the Jains and other classes who come here for business from Gujerat or Kathiawar and live in these buildings ; they suffer as much from thrift as other classes from want of thrift ; they seldom eat fruit, and they use very little vegetables, unlike most Hindus. They are so thrifty that they collect rags and rubbish in the passages of the dwellings, and so careful of animal life that they fear to sweep near the rags they have with much pains bound in bundles. I have never seen any people so indifferent to the sight of the dying and the dead. This is what the Committee appointed by Government saw one evening during the inspection of a building. In one room of a large building with double rooms on each floor, was a patient ill from bubonic plague. In the next room was a man singing. In the room after that, there was a dead body. And in a room almost after it a group of women were laughing at us. It was often pathetic to see the anxiety of some people to save an insect from disinfecting fluid.

The mortality has been so small in proportion to the numbers and the pressure of the population and the density of the houses, that it has suggested to some authorities that there may be another severe epidemic. All who have seen the charts of mortality have ascribed the repressions in the mortality to the influence of the sanitary measures adopted. There can be no doubt that the measures adopted have reduced and lightened the mortality. There is no reason except the influence of the measures carried out why in this city more densely crowded than any city in the British Empire the mortality has not been much greater.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM BUBONIC PLAGUE BY SECTIONS DURING 1896.

Sections.	Population by Census of 1891.	No. of Deaths from Bubonic Plague.	Rate of Mortality per 1,000 of Population.
Upper Colaba	4,335	1	·23
Middle and Lower Colaba...	13,622	77	5·65
Fort, Southern	3,951	2	·50
Fort, Northern	32,847	46	1·40
Esplanade	10,064	1	·09
Mandvi	37,295	308	8·25
Chukla	32,197	58	1·80
Umarkhadi	52,466	84	1·60
Dongri	30,317	95	3·13
Market	44,751	87	1·94
Dhobi Talao	39,945	110	2·75
Fanaswadi	24,069	32	1·32
Bhuleshwar	38,363	68	1·77
Khara Talao	27,035	51	1·88
Kumbharwada	32,209	83	2·57
Khetwadi	28,814	48	1·66
Girgam	26,999	42	1·55
Chaupati	11,512	7	·60
Walkeshwar...	12,990	5	·38
Mahalakshmi	17,014	7	·41
Mazagon	33,640	93	2·76
Tarwadi	21,298	20	·93
2nd Nagpada	18,768	29	1·54
Kamathipura	29,203	227	7·77
Tardeo	18,980	31	1·63
Byculla	47,403	88	1·85
1st Nagpada	11,133	27	2·42
Parel	28,740	23	·80
Sivri	6,063	13	2·14
Sion	19,601	5	·25
Mahim	18,505	12	·64
Worli...	25,493	41	1·60
Water Division	22,142	2	·09
Non-resident and unknown	—	113	— .
Total	821,764	1,936	2·36

Up to the end of 1896, the highest mortality from bubonic plague had occurred in Mandvi, 308 deaths having been registered, equal to a mortality of 8·25 per 1,000, while in Kamathipura the death-rate was 7·77, Middle and Lower Colaba 5·65, Dongri 3·13, Dhobi Talao 2·75, Mazagon 2·76, Kumbharwada 2·57, and 1st Nagpada 2·42. The lowest mortality was registered in the Esplanade, ·09. Yet this section joins Mandvi on the north and is separated by only the Carnac Bunder Bridge Road. It is interesting that, although in the Esplanade on the Mandvi side there are chawls occupied by numbers of low-castes, amongst others, the Municipal scavengers, working in Mandvi, the disease had not spread to the locality. It will also be observed that in the north of the Island, only 5 cases had occurred in Sion on the East, and 12 in Mahim on the West, while further south in Parel the disease was advancing, and 23 deaths had occurred. In the district immediately on the city side of Mahim, *viz.*, Worli, 41 deaths had occurred. If we go to the west side of the Island, we find that in Chaupati only 7 deaths had occurred, while further west in Walkeshwar and Mahalakshmi only 5 and 7 deaths had been registered.

The mortality in Mandvi commenced to decline in the end of October, but the progression of the disease was observed to continue westward, southward and northward.

The table showing the mortality by sections read with the diagram,* exhibiting the order of the occurrence of the first cases, shows the steady progression of the disease from east to west and from south to north. It may be observed that to the extreme north and to the extreme west of the island, the disease had only spread by the end of the year. The gradual progression of the disease seems to have been due to the migration of rats. There is no other explanation that occurs to me, for, had the disease followed the course of the migration of the population, it would at this period have been most general and fatal in the north and west of the island in the localities whither people had migrated in thousands in the beginning of October and in large numbers afterwards. As I have observed before, there was a steady progression in the disease. A movement from the foreshore on the east that seemed to follow the migration of rats from one district to another, as in a garden having many buildings, when the rats are poisoned in one building, they migrate to another, so in the city they seemed to advance when sick from one district to another.

Previous to the appearance of the disease in an epidemic form in Walkeshwar, large numbers of rats were found dead on the paths leading to the hill. They attracted our attention, lying, as they did, in one characteristic position.

It will be observed from the diagram* of the progress of the disease across the Island to the Walkeshwar district that up to a late period, although a number of cases had occurred in the intervening districts and in the same locality of Walkeshwar, the disease had not become epidemic in Walkeshwar, but when that period—the epidemic period as I may call it—in the progression of the disease arrived, and the epidemic had spread across the intervening districts to Walkeshwar and not till then the disease became epidemic in this district. It has to be carefully noted whether there is a direct connection between the sporadic cases and the cases of the epidemic period that appear to follow them at varying intervals. The term incubation applied to the period intervening between the time of the first observed case and occurrence of other cases is very vague.

I have already stated that the highest mortality from Bubonic Plague was registered in Mandvi, 308 deaths out of a total mortality of 1,945, giving a death-rate of 8·23 per 1,000. After Mandvi, Kamathipura suffered most, 227 deaths having occurred, equal to a death-rate on the population of 7·77. Middle and Lower Colaba, which was most affected after Mandvi and Kamathipura, had a mortality of 77 deaths, equal to a death-rate of 5·65 per 1,000. The first cases in Middle and Lower Colaba were labourers in the cotton godowns, and they were going backwards and forwards between Mandvi and Colaba. It is a curious coincidence that the first cases in Mandvi occurred over godowns, and that the first cases in Middle and Lower Colaba occurred in godowns. In Dongri a district adjoining Mandvi the incidence of the mortality is next in severity to Colaba. It is remarkable that it was not higher as the two districts are separated by a narrow road on the north side of which is Dongri, and the south side of which is Mandvi with high and crowded houses on either side. From the beginning people were going backwards and forwards from Mandvi to Dongri and from Dongri to Mandvi. The labouring classes in Mandvi moved about constantly from houses where cases occurred. A very remarkable instance of immunity was observed in the case of the Common Jail in the Mandvi Ward, not one case occurred in this Jail, amongst over 300 prisoners although the buildings are in the centre of an infected area.

From the table showing the mortality by class, it will be seen that amongst the large communities, with the single exception of Jains, the mortality up to the end of 1896 had

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* Not re-printed.

not risen above 2·91 per 1,000. It will also be observed that, with the exception of Europeans, the mortality was lower amongst Mussalman than in any other large class. The death-rate amongst Europeans was ·08 per 1,000, and amongst Eurasians ·92, only 4 deaths having occurred in the latter community.

The mortality amongst Jains is unequally distributed by sex, being 8·69 amongst males and 6·77 amongst females. The inequality in the ratio of sex-mortality amongst Bhatis was probably due to females leaving Bombay and a reduction in the female population. The inequality in the sex-mortality is very great amongst Mussalman, being 1·18 amongst males and ·768 amongst females.

Amongst Parsees the ratio of mortality amongst males and females was more equal than in most other classes.

TABLE SHOWING THE NUMBER OF DEATHS FROM BUBONIC PLAGUE IN DIFFERENT CLASSES AND THE DEATH-RATE PER 1,000 OF POPULATION IN THE YEAR 1896.

CLASSES.	Males.			Females.			Persons.		
	Population.	No. of Deaths.	Rate per 1,000.	Population.	No. of Deaths.	Rate per 1,000.	Population.	No. of Deaths.	Rate per 1,000.
Jains	19,317	168	8·69	5,908	40	6·77	25,225	208	8·28
Brahmins	26,564	70	2·63	11,418	20	1·75	37,982	90	2·34
Lingayets	462	6	12·98	322	—	—	784	6	7·65
Bhatias	4,344	19	4·37	3,547	4	1·12	7,891	23	2·91
Hindus of other caste	288,569	811	2·79	162,896	379	2·32	451,465	1,190	2·63
Do. low caste ...	25,888	78	3·01	19,281	34	1·76	45,169	112	2·47
Mussalman	94,975	113	1·18	60,126	41	·68	155,101	154	0·98
Parsees	24,705	41	1·65	22,753	26	1·14	47,458	67	1·41
Jews	2,590	6	2·31	2,431	4	1·64	5,021	10	1·99
Native Christians ...	20,040	55	2·74	9,672	15	1·55	29,712	70	2·36
Eurasians	2,294	2	·87	2,036	2	·98	4,330	4	0·92
Europeans	8,118	1	·12	3,172	—	—	11,290	1	0·08
Negro-Africans ...	90	—	—	56	1	17·85	146	1	6·84
Chinese	137	—	—	53	—	—	190	—	—
Other and Unknown castes.	—	—	—	—	—	—	—	—	—
Total ...	518,093	1,370	2·63	303,671	566	1·88	821,764	1,936	2·53

The mortality by age periods is most interesting. The highest mortality amongst males occurred at two age periods between 10 and 20 and 25 to 30 years of age, while the highest fatality amongst females occurred from 10 to 14 years of age and from 25 to 29. In both sexes the incidence of mortality was lowest under 5 years of age. It is possible that the low mortality at early periods of life may have been due to imperfect registration and not merely to the concealment of cases but to the difficulty of recognition in cases amongst children.

The mortality at nearly all periods of life was lower amongst females than males.

Digestive Diseases of the System.—The mortality from the diseases of the digestive system is 614 more than in the last year and 632 more than the average of the last five years. Of the deaths from diseases of the digestive system, 1,613 were ascribed to diarrhœa, being 425 more than in the last year and 381 more than the average ; and 737 were referred to dysentery, being 112 more than in the last year and 133 more than the average. To all other diseases of the digestive system 755 deaths were ascribed, being 77 more than in the last year and 118 more than the average.

Diseases of the Respiratory System.—From diseases of the respiratory system 5,334 deaths were registered, being 769 more than in the last year and 638 more than the average. Of the deaths from diseases of the respiratory system, 3,021 were referred to bronchitis, being 389 more than in the last year and 127 more than the average. 1,590 were referred to pneumonia, being 236 more than in the last year, 424 more than the average.

Diseases of the Nervous System.—From diseases of the nervous system 2,272 deaths were registered, being 228 more than in the last year and 11 more than the average.

Births.—During the year 15,890 living and 1,598 still-born births were registered, being 206 more than in 1895. Of the living births, 8,267 were males and 7,623 females. The proportion of males to females by the census of 1891 was as 170·60 to 100, and assuming that there were 100 females to 100 males, the birth-rate would be equal to 32·97 per 1,000 of population. This is the largest number of births registered since 1889.

APPENDIX.

No. 1.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1896.

The year, in general terms, was one of unusual heat and deficient rainfall, the latter no doubt contributing to the production of the former. During the monsoon period, which was characterised by a rainfall more or less steadily in defect, the temperature was above the normal; whilst preceding the setting-in of the monsoon, which was late in its arrival, and following its early cessation in September, the heat was excessive. The tracts of country in Southern, Central, and Northern India chiefly affected by these conditions of unusual heat and scanty rainfall suffered, more especially towards the end of the year, from failure of crops, high prices and consequent privation. Mortality was in excess of the average for the preceding five years during the first nine months, and greatly less than the average during the last three months of the year. The lessened mortality of the last three months is no doubt rightly attributed to their unusual dryness and the consequent decrease of malarial diseases.

2. *European Army of India.*—The year 1896 was healthier than its predecessor. The ratio of constantly sick was 94 and the same in both years; but the ratios of admissions into hospital and of mortality show a considerable decrease in the year under report, having been 1,387 and 14·84 respectively, as compared with 1,462 and 15·26 in 1895. The loss to the Army, on the other hand, from invaliding rose from a ratio of 39 in the two preceding years to a ratio of 43 per 1,000 of strength. As usual, venereal diseases and ague were the chief causes of admission into hospital, the former accounting for 37 per cent. and the latter for 17 per cent. of the total sickness from all causes. As usual, also, enteric fever was the most fatal disease, no less than 43 per cent. of the total number of deaths having been due to this cause alone. No other disease was the cause of so much invaliding as secondary syphilis. The total number invalided during the year was 1,966; and of this number secondary syphilis accounted for 448. The diseases which most closely followed secondary syphilis as causes of invaliding were debility, which accounted for 184, and tubercle of the lung, which accounted for 141 cases. In reviewing the provincial Sanitary Reports we found that the months of greatest sickness amongst the general population in 1896 were not, as is usually the case, the last but the first months of the year. So, likewise, in the case of the European Army, the month of maximum sickness was not September, the month of maximum sickness in the five-year period 1890–94, but the month of January. The explanation given of this transfer of greatest sickness from the end to the beginning of the year is doubtless applicable both to Europeans and Natives. The early cessation of the rains, and consequent dryness of the latter months of 1896, would account for diminished sickness and mortality from diseases of malarial origin; whilst the unusual prevalence of influenza and pneumonia would account for the increase of sickness in the beginning of the year. The mortality from these latter diseases, it is true, were mainly attributed to fever in the returns for the native population; but good reasons were given by some of the provincial Sanitary Commissioners for their belief that deaths really due to influenza and chest affections were recorded under the head of fever.

3. Of the different Commands, Bengal gave the highest death-rate during the year, whilst the death-rate of Madras was about half that of Bengal, and the lowest of all the Commands; in the former it was 18·70 and in the latter 9·79. It is disappointing to read that "the percentage of "enteric fever to total admissions in 1896 was greatest in the hills." No less disappointing is it to find that the highest death ratios in large garrisons with a strength of over 1,000, were recorded in Allahabad, Fyzabad, Lucknow, and Agra, when it is remembered that in all of these, excepting Fyzabad, there is a supply of filtered pipe water. In Allahabad the ratio of mortality was "more "nearly four than three times higher" than during the preceding year. The cause of this great increase was enteric fever. Referring to Table V., which gives an abstract of the cantonment Sanitary Reports of the most unhealthy stations, it is found stated that "enteric fever broke out in "the 1st Norfolk Regiment in February, and lasted till the end of April, and again re-appeared "towards the end of December. On both occasions the filter beds of the municipal water-supply "were found to be infected with the enteric microbe." It is added, "the quality of the water is "excellent, except for the finding of the enteric microbe on two occasions." It would have been useful to have been assured that the microbe had been searched for but shown to be absent from the filter-beds during the rest of the year. It can hardly be believed that the microbe continued to exis. in the filter-beds from February until the end of April. If it was looked for and found when enteric fever first showed itself in February, it may be assumed that measures were adopted without delay to cause its disappearance from the filter-beds, or that the source of the water-supply for the regiment was changed, or the water boiled before use. It was confidently predicted by many that the introduction of a filtered water-supply for the use of garrisons would be followed, if not by the disappearance of cholera and enteric fever, at all events by a marked decrease of both. In Fyzabad

the water is drawn from covered wells "which cannot easily be contaminated." In Agra, Allahabad, and Lucknow water is supplied in all three from the municipal waterworks. In the case of the two former, enteric fever is credited to the water thus supplied, but in Lucknow, "it has not been "possible to trace the cause of enteric fever in particular instances, but every year shows how readily "the water, milk, cheese, and other articles of food can be contaminated by the enteric bacillus, "chiefly through the filthy habits of the natives (cooks and others) with whom the soldier is brought "in contact."

4. *Principal Diseases.—Influenza*, which was prevalent in the end of the preceding year, reached its maximum in January of the year under report. In that month 262 admissions into hospital were due to it, whilst the total admissions for the year were 808, or equal to a ratio per mille of strength of 11·5. The months of greatest influenza prevalence, taking the average of the years since 1890, were March and April, and of least prevalence August and November. There were eight deaths from the disease, and a ratio of 61·03 constantly sick. Influenza has thus become a not unimportant cause of sickness and mortality amongst the troops.

5. *Cholera* was more prevalent than during the preceding year, but the mortality caused by it was less than the average for the decennium 1886–95. The attacks numbered 70, or one for each 1,000 of the strength of the Army, and of those attacked only seven recovered. The stations which suffered most were Poona, Benares and Jhansi. In Table V. no account is given of Poona, but of the outbreak at Benares it is said, "cholera is always more or less epidemic. No particular cause could be assigned "for the outbreak in March." At Jhansi there were 10 cases in the months of March, April, May, and July. Regarding this outbreak it is stated, "cholera, which was imported, was unusually "prevalent. The infantry suffered more in consequence of the disease being brought by recruits "joining the regiment from England." Notwithstanding the confident assertions of many writers that cholera is caused by the *comma bacillus*, we find the following to be the latest pronouncement by the Sanitary Commissioner with the Government of India, based on his examination of the evidence recorded by some of the most distinguished bacteriologists who have devoted themselves to the study of this disease :—"The statement that cholera is caused by a particular vibrio must remain "an assumption until the circumstances under which that vibrio is potent to cause cholera have been "discovered." Further, it is added :—"Dr. Klein has frequently isolated genuine vibrios derived "from cases where no connection with Asiatic cholera could be traced." The assertions constantly met with to the effect that the *comma bacillus* is the cause of cholera may well fail to convince when, as the result of Klein's latest researches, we are told that "commas, then, were found in cases "which, clinically and from their antecedent circumstances seemed to justify the exclusion of "cholera from the diagnosis ; and cases occurred in which, clinically and otherwise, the presence of "cholera was indicated, but the commas were absent." Clearly, further research into the etiology of the disease is required before this question of the connection between the *comma bacillus* and cholera can be regarded as finally settled. In India there is never any lack of opportunity for carrying on such research : in the year under report the deaths recorded as due to cholera numbered 471,779 : the number is in some years greater and in some years less. Hitherto, the method of dealing with outbreaks of the disease amongst collections of people which has proved most successful has been the prompt evacuation of the infected locality. As the Sanitary Commissioner puts it :—"Until we know exactly what the cause of cholera is, it is clearly impossible to remove that cause "from a body of men ; but we can remove the body of men from the cause. And movement, in "India at any rate, is the one sovereign remedy : it rarely fails, and when it does fail, the failure "can, generally, be traced to the neglect of reasonable precautions." The two methods of preventing cholera advocated and practised by Mr. Hankin and M. Haffkine are intended, the one to destroy the cause of the disease by chemical agencies, and the other to produce immunity from the disease, in much the same way as immunity from small-pox is produced by vaccination. Mr. Hankin endeavours to destroy the cause of cholera in water, it being the generally accepted belief that cholera is chiefly, if not entirely, a water-borne disease : M. Haffkine by his anticholeraic inoculations endeavours to render the system proof against cholera. Evidence in support of both methods is adduced ; but further experience in their application will be required before they can be accepted as affording effectual protection against cholera, and capable of being applied in practice on an extensive scale.

6. The prevalence and fatality of *small-pox* have been lamentable : there were 122 cases with 10 deaths against 19 cases and two deaths in 1895. Such mortality in a body of men, who may be, and, it is presumed, are subjected to the full prophylactic influence of vaccination, may well lead to inquiry into the cause of the failure of vaccination to protect against fatal attacks of small-pox. Many will still hesitate to accept the conclusion that vaccination is not the efficient protection against death from small-pox which it has hitherto been considered to be ; and will confidently adhere to their belief that where primary vaccination has been efficient, and has in due course been followed by successful re-vaccination, a death from small-pox will be, if not absolutely unknown, exceedingly rare. This seems to be the conclusion at which one of the recent writers on the disease has arrived. The last part of the quotation made by the Sanitary Commissioner from this writer's article on small-pox is here reproduced :—"I have not, however, seen fatal small-pox in any one whose primary "vaccination was efficient, and who also had been successfully re-vaccinated." Some would hesitate to accept the following case as a proof of the insufficiency of vaccination and re-vaccination to protect against a fatal attack of small-pox :—"Bareilly.—Gunner W. had one distinct mark on the right arm. "He had been in 1891 and in 1894 unsuccessfully re-vaccinated. He died of confluent small-pox." Few experienced in vaccination work would consider "one distinct mark" to be a satisfactory proof of efficient primary vaccination. With regard to the failure on two occasions of re-vaccination, it would have been interesting to have been told, whether the lymph used was taken direct from the calf or the arm, or whether it was preserved lymph, and if so, for how long and in what way it had been preserved. The sickness and mortality arising from small-pox during 1896 would seem to suggest the need for an inquiry into the question of the efficiency of the system adopted for the protection of the Army in India against small-pox by means of vaccination.

7. As in the case of the general population, so in that of the Army, there was a marked decrease in the prevalence of ague. The admissions fell from 336 per thousand of strength in 1895 to 239 in the year under report. This decrease was no doubt due to the year having been "the driest on "record," and to the consequent diminution of malaria. The following quotation from the report before us is significant of the difference of opinion and practice still prevailing amongst medical officers with regard to fevers in India:—"Medical officers sometimes note that cases returned as "simple continued fever may have been mild cases of enteric fever; and they differ in practice as to "where they draw the line between simple continued fever and enteric fever, as well as between "simple continued fever and ague."

8. *Enteric fever* continued its destructive course with little substantial abatement. There were 1,795 admissions into hospital and 445 deaths, against 1,870 admissions and 447 deaths in the previous year. As compared with the decennium 1886–95 there was no decrease. The ratio of deaths per 1,000 of strength was 6·31 in the year under report: 6·72 in the preceding year; and 5·2 for the decennium 1886–95. It must be allowed, therefore, that however great the advance which has been and is being made in our knowledge of the etiology of enteric fever, the application of this knowledge to the prevention of the disease has hitherto been productive of little appreciable effect. Believing, as most do believe, that the drinking water is generally the medium through which the human body becomes infected, attention has chiefly been directed to an examination of the water in use when there has been an outbreak of the disease, and to the adoption of measures for securing a supply guaranteed by bacteriological and chemical tests to be free from pollution. It might be supposed that, when the ways of entrance of infection into the body had been traced and narrowed down to a single avenue, the exclusion of the disease, if a constant watch were kept over this avenue, would be possible. But this has not been found to be the case. The reports of medical officers show much difference of opinion regarding the effect of the means used to purify the water at different stations. Numerous instances of this might be given, but it will suffice to quote from some of the abbreviated reports on pages 31, 32:—"Dinapore.—All the wells in cantonments were "disinfected with the permanganate of potassium during the month of April, and the cisterns in "which the drinking water is kept after being boiled are cleaned out once a week with the "permanganate of potassium. The effect of boiling the water has been very remarkable in checking "the number of admissions from enteric fever and dysentery." Again:—"Benares.—During January, "February and the greater part of March the water used was from the wells in cantonments. There "were during that period no enteric fever cases. On removal into sanitary camps, the water was "carefully boiled. Enteric fever from that time became nearly epidemic. On the return of the men "the water was obtained from the municipal waterworks, and was also boiled, but without affecting the "prevalence of enteric fever in the least." The report from Lucknow, after stating that Mr. Hankin found the enteric microbe in four out of six samples of water taken from different standposts in cantonments, goes on to say that, although the microbe was thus shown to be present in the cantonment mains during September and October and to be widely diffused, "there was no corresponding "increase, but rather a marked diminution in the number of cases as compared with the earlier "months of the year." The report concludes:—"From the above data one of two conclusions seems "inevitable, either that the microbe found was not the special cause of enteric fever, or that the "microbe can be consumed with impunity by all but a very small percentage of people." The effect of the permanganate of potassium on the microbe would not seem to be destructive, if the observations made at Agra are to be relied on, "the microbe was also found in a flourishing condition in the pink "water in the receptacles used for holding the drinking water both in hospital and barracks, although "every care was taken and the permanganate solution introduced at night, so as to secure the "necessary effect." Apparently in despair of excluding the cause of enteric fever by sanitary measures, one Medical Officer writes:—"Nothing but inoculation of every young soldier with "preventive serum will, I believe, stamp out enteric fever from the Army. Sanitation, pure and "simple, applicable as it is only to certain limited areas and under the most favourable place—time "conditions, has failed, and, I am convinced, will fail to extinguish the disease."

9. *Venereal disease* continued to prevail with about the same severity as during the previous year. The admission rate was 511·6 per thousand of strength as compared with 522·3 for the preceding year. There was some decrease of admissions from primary, and a great increase in the admission rate from secondary, syphilis. The latter was the highest on record. As with enteric fever, so with venereal diseases, the influx year by year of large numbers of young soldiers under the short service system has been accompanied by a marked increase of both diseases. The Sanitary Commissioner shows that, as the proportion of young soldiers has increased and the proportion of married soldiers has diminished the venereal ratio has gradually risen. There were equivalent to over three regiments constantly sick in hospital from venereal disease. The increase in the prevalence of secondary syphilis is of specially ill omen, "this is a condition of things sure to tell when the men have to go on field service."

10. *Native Army.*—The health of the Native troops was better than during the previous year. The constantly sick decreased from a ratio of 30 to 29 per thousand of strength; and there was a marked decrease in the ratio of deaths. This last, which was 15·71 in 1895, fell to 12·57 in the year under report. The improvement is attributed to the dry and non-malarious character of the year. At the same time, the admission rate from ague, which was 36·21 per mille in 1895, continued to be 36·22, or practically the same in both years. As in previous years, the contrast between the European and Native Armies in respect of the incidence of the diseases to which mortality was due is striking. Of every 100 deaths in the European Army, 43 were caused by enteric fever; whilst in the Native Army only a fraction, 0·4, of every 100 deaths, was due to this disease. On the other hand, the number of deaths in the European Army from pneumonia amounted only to 4·3 of every 100 deaths from all causes; whilst in the Native Army the number was 30·8 out of every hundred. So with Remittent fever, of every 100 deaths in the European Army from all causes, 2·7 were due to this disease; whilst in the Native Army the number in every 100 was 10·5. No satisfactory explanation has hitherto been given of the almost complete immunity of the Native

soldier from enteric fever. The assertion which some medical officers are in the habit of making that the majority of Native children have attacks of enteric fever which confer immunity from further attacks during the rest of their lives, has never been supported by a record of cases of the disease amongst Native children, and seems to be merely a hypothesis invented to account for an immunity which is not understood. The greater liability of the Native than of the European soldier to respiratory diseases is no doubt accounted for by the fact that the latter is better fed, clad, and housed.

11. From influenza, cholera, and small-pox the ratios of admissions did not widely differ in the two Armies. From the first of these they were almost the same in both, having been 11·5 in the European and 10·7 in the Native Army. From cholera the admission rate was identical in both Armies, although the death-rate was somewhat higher amongst European than amongst Native soldiers. Contrary, however, to what might have been anticipated, both the admission and the death-rates from small-pox were higher in the European than in the Native Army.

12. Of the prevalence of *Scurvy* in the Native Army, the Sanitary Commissioner, after showing that the regiments on the frontier, where vegetables are grown with difficulty or are hard to procure, are most afflicted by scurvy, goes on to say :—"But the amount of scurvy existing is far greater than "the amount returned, and medical officers who have not returned many cases of scurvy frequently "refer to the existence of a more or less wide-spread scorbutic taint in their regiments." His advice in this connection is deserving of the attention of all concerned with the maintenance of the health and efficiency of the Native Army :—"No pains should be spared to eradicate scurvy completely, "either by securing an adequate supply of good vegetables, or by increasing the amount of the "ordinary diet and providing variety in the ingredients; because it underlies a vast amount of "sickness that does not directly bear its names."

13. The sickness and inefficiency from *venereal diseases* amongst the Native troops remain much the same from year to year. The admission rate due to them was 37·1 per 1,000 of strength, as compared with 511·6 in the European Army. "Those Native troops that are serving far away from "their homes, and are separated from their families, appear to be most affected by venereal disease, "and several medical officers notice it. The Gurkhas are the most conspicuous example of this. "Some medical officers notice that venereal disease is most frequent among recruits and young "soldiers." Of the 24th Madras Infantry at Quilon it is reported that the restrictions placed on marriage, and the consequent increase in the number of bachelors, have produced a rise in the amount of venereal disease. From such facts it may be concluded that the special conditions which are known to have led to the disastrous increase of venereal disease in the European Army have a tendency to produce a similar effect in causing its increase in the Native Army.

14. *Jails.*—The ratios of admissions into hospital, and of the constantly sick would indicate that the year, as regards prisoners, was a comparatively healthy one. The admission rate per mille of strength fell from 1,082 in the previous year to 983 in the year under report; whilst the constantly sick-rate fell from 44 in the former to 41 in the latter. The death-rate was practically the same in both years. The average annual strength of prisoners was higher than in 1895, a consequence of the scarcity which prevailed, more especially towards the end of 1896. It might have been expected that the effect of scarcity, by sending numbers of ill-fed persons to jail for petty thefts, would have been to raise the sick and death-rates; but this effect was more than counterbalanced, in the jails of India as a whole, by the abnormal dryness of the year and the consequent diminution of malarial diseases. Where, however, scarcity amounted to actual famine, as in the Central Provinces, the returns show that the proportion of prisoners to population increased from a ratio, per 1,000 of the latter, of 4·6 in 1895 to a ratio of 5·2 in 1896; and that the mortality in the jails rose from 55·95 in the former year to 72·36 in the latter. Consequent upon a series of years of bad harvests in the Central Provinces, the jail sick and death-rates are measures of the state of health caused by the privations to which the outside population were subjected, rather than of the good or bad hygienic conditions prevailing in the jails. If a jail is filled with ill-fed, emaciated prisoners, the death-rate will be high, however excellent the hygienic state of that jail may be. And the same cause which in times of famine enfeebles the people of a country will probably send them to jail in numbers so great that overcrowding is likely to result, with the ill effects on health arising therefrom. Such overcrowding prevailed in the jails of more than one of the provinces afflicted by scarcity or famine in 1896.

15. The high rate of mortality from bowel complaints amongst prisoners as compared with the rate in the European and Native Armies has been noted from year to year. "Taking the mortality of the "Native troops from bowel complaints as 1, that of the Europeans is 1·2, and that of the prisoners "14·1." Likewise, with regard to deaths from respiratory diseases; whilst the Native suffers greatly more than the European Army, the prisoners suffer more than both. "Taking the mortality of the 'European troops from respiratory diseases as 1, that of the Native troops is 4·8, and that of the "prisoners 6·9." As concisely put by the Sanitary Commissioner, "the chief cause of death among "European troops was fevers, among Native troops respiratory diseases, and among prisoners bowel "complaints."

16. *Summary.*—Generally speaking, the year was one of unusual heat and deficient rainfall. Failure of crops and high prices, more especially towards the end of the year, caused much privation in some provinces; but the abnormal dryness and consequent diminution of malarial diseases tended to neutralize the effect of these influences on the death-rate. Judging from the decreased rate of admissions into hospital and of mortality, the European Army of India was healthier than during the preceding year, but there was a considerable increase in the ratio of invaliding. Of the Commands, Bengal gave the highest death-rate during the year, and Madras the lowest, the rate for the latter Command having been little more than half that of the former. Influenza in the early months was a not unimportant cause of sickness, and cholera was more prevalent than in 1895. The number of attacks from the latter disease was 70, and all proved fatal except seven. Another year's research has

done little to advance our knowledge of the etiology of cholera, although India continues to afford ample opportunity for its study, nearly half-a-million of deaths having been recorded as due to it during the year under report. In point of efficiency in cutting short an outbreak of cholera amongst the troops, no remedy has hitherto been found equal to withdrawal from the affected locality. Small-pox has been unusually prevalent and fatal, 10 deaths having resulted from this so-called preventible disease. Such mortality seems to suggest the need for special inquiry into the efficiency of the system of vaccination in force for the protection of the European Army against small-pox. There was a marked decrease in the prevalence of ague, due no doubt to the year having been the driest on record. Enteric fever pursued its destructive course without substantial abatement. There is much conflict of opinion amongst medical officers as to the most efficacious method of purifying the water-supply, the medium by means of which, it is generally believed, the disease obtains entrance into the system. Venereal diseases continued to prevail with much the same degree of severity as in recent years. An especially unfavourable feature of the returns is the increase in the number of men shown to be affected with secondary syphilis. Of the Native, as of the European, Army the health has been better than during the previous year. The almost complete immunity of the Native troops from enteric fever, and their comparative immunity from venereal diseases, continue to be marked. On the other hand, chest affections were, as usual, greatly more prevalent and fatal amongst the Native than amongst the European troops, and were accountable, amongst the former, for a large proportion of the year's mortality. Prisoners, as in previous years, suffered more than either European or Native troops from bowel complaints. In parts of the country, such as the Central Provinces, in which the harvests had failed for a series of years, and the people had suffered much from privation, the death-rate amongst the prisoners was very high.

12th October 1898.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1896.

The meteorological features of the year were abnormal. The rainfall was scanty, unseasonable, and irregular in its distribution, resulting in failure of crops and wide-spread scarcity which deepened into famine, and affected a population of upwards of 13 millions. The temperature was high in February, March, and April, as well as in the extreme west of the province in May: the mean continued during the third quarter generally above the normal almost over the whole province, especially in North Bengal and Bihar. In the last quarter it was almost constantly hotter than usual in the day-time throughout October and November. What between the scarcity due to short or unseasonable rainfall pressing hard upon the poorer classes and weakening their resistance to disease, unusually high temperature for the greater part of the year and deficient and impure water-supplies consequent on drought, it was no more than was to be expected that the public health would suffer. Although it can hardly be said that there was anywhere famine owing to actual want of food, prices rose so high as to place it beyond the means of the poorer classes to purchase enough to keep themselves and their dependants in health. The resources of the State had at length to be employed, and distress relieved through the agency of a special establishment, and at the cost of a vast expenditure of money. Owing mainly to these causes, 1896 was an unhealthy year.

2. *Vital Statistics.*—The recorded *birth-rate* rose from 34·59 during the preceding year to 38·03, and the *death-rate* from 31·39 to 34·17. These are still, doubtless, below the actual rates; but they show that registration in Bengal is steadily improving, and give promise that in a few years, if progress is maintained, birth and death statistics will afford fairly accurate information regarding the health conditions of the people of the province. The Sanitary Commissioner thinks that there are good reasons for believing that the actual birth and death rates in Bengal are not much, if at all, below the estimated ratio of 51·8 per thousand of population in the case of the former, and 44 in the case of the latter.

3. Whilst the registration of births and deaths is rapidly improving in Bengal, it is not always quite easy to say, when the numbers of these are seen to increase, how much of the increase is due to the fact that fewer omissions have been made from the registers, and how much to greater fecundity and greater mortality. That the year 1896 was more unhealthy than its predecessor there can, however, be no question. "Not only do the figures show this," writes Dr. Dyson, "but the fact is borne out by the personal observation of district officials "and myself." Cholera and fever were more than ordinarily destructive of life, the former being credited with a death-rate of 3·19 against 2·49, and the latter with a rate of 24·76 against 22·99 in 1896. The causes which led to the increased prevalence of these diseases are believed to have been chiefly those already mentioned, abnormal meteorological conditions and scarcity following crop failures.

4. The incidence of these two chief causes of mortality was different in towns and in the country. Whilst fevers were greatly less destructive in towns than in the country, the contrary was the case with regard to cholera. The ratio of fever deaths was only 19·04 in towns, whilst it was 25·06 in the country. Cholera, on the other hand, is credited with a mortality ratio of 5·14 in towns as compared with 3·09 in the country. The greater prevalence of fevers in rural as compared with urban Bengal is attributed by the Sanitary Commissioner to the almost

entire absence of drainage and to the bad water-supply in rural areas. It might also be suggested that diseases may be somewhat more accurately differentiated in towns than in villages, in proportion to the higher level of education and intelligence of the towns people as compared with the rural population.

5. As children are more sensitive and succumb more readily to unhealthy influences than adults, the ratio of mortality amongst them may be taken as a useful measure of the healthiness or unhealthiness of a season. Infants under one year of age died at the rate of 222·34 per thousand in 1896, as compared with a rate of 195·50 in the previous year. Children of one year and under five years died at the rate of 45·47 and of 40·81 in these two years respectively.

6. *Chief Diseases.*—"In a year of scanty rainfall, irregularly distributed, it is only to be "expected that the mortality from *cholera* will be high, because there is no water to flush out "polluted tanks and wells, which are the chief sources of the water-supply of the people of "Bengal." So writes the Sanitary Commissioner; but an examination of the diagram inserted between pages 24 and 25 of his report would seem to furnish exceptions to his conclusion, that during the past year of scanty rainfall cholera mortality was high when there was no water to flush out polluted tanks and wells. If, for example, the portion of the diagram referring to the Chota-Nagpur Division is looked at, it will be seen that the four months of greatest cholera prevalence, May, June, July, and August, were also the months of heaviest rainfall. In the Orissa Division, also, it will be observed that, whilst there was heavy rainfall in June and July, followed by still heavier in August, cholera not only did not subside but increased during the latter month, the mortality caused by it rising from a ratio of 0·22 in July to 0·4, or nearly double, in August. It would have been interesting to have had the Sanitary Commissioner's opinion regarding the prevalence of cholera in Calcutta and other towns supplied with pipe water. Looking at the returns of cholera for Calcutta, it appears that the ratio was very high, 5·06, and yet the water-supply may be assumed to be to some considerable extent constant in quantity and quality, whatever the nature of the season. However, in all the districts in which cholera prevailed with greatest severity the local officers, it is stated, ascribed the cause of this severity "to deficient and irregular rainfall, and consequently "a more than usually polluted water-supply." Only in Mozaffarpur, a district in which cholera was more prevalent and fatal than in any other of Bengal, does the Civil Surgeon, Dr. Peck, differ from this conclusion, and give facts to support his opinion that the water-supply was not the cause of the disease. "In the southern and central parts of the district where people were "drinking from stagnant puddles owing to the wells being dry, cholera was not nearly so "prevalent as in the north where the wells were numerous and contained plenty of water, viz., "Sitamarhi sub division and notably the Poopri *thana*, which contributed 4,564 deaths from a "population of 232,114. In the Poopri *thana* the wells are good and numerous and nowhere "in Sitamarhi was the water so low as in Mozaffarpur." The Civil Surgeons had their attention directed by Dr. Dyson during the year to the use of permanganate of potash, lime, and alum for the purification of the water of tanks and wells. "It appears," he says, "from the annual "reports of the local medical officers who tried the experiment, that it had a very marked and "beneficial effect." Some extracts are given from the annual reports of certain Civil Surgeons who carried out this method of water purification. One of these extracts, from the report of the Civil Surgeon of Balasore, runs as follows:—"Tanks which were in infected areas were "disinfected with permanganate of potash, which had a marked effect in checking the disease." The Civil Surgeon of Gya writes:—"From various inquiries I made when on tour I am disposed to "believe that the treatment of wells with permanganate of potash was especially effectual in stopping "the spread of cholera." Evidence of this nature may be interesting but is too general and inexact to carry much weight. Anti-cholera inoculation has been carried out during the year; but until a greater number of inoculations has been performed and the subsequent history of each case carefully traced and recorded, it would be premature to give an opinion regarding the nature of this method of conferring protection against cholera.

7. *Small-pox.*—The ratio of 0·18 deaths from this disease was the same during the year 1896 as during the preceding year. As might have been looked for, the only district in which the disease can be said to have prevailed in epidemic form was one in which vaccination is backward. It is not at all surprising to learn that vaccinators of the *Mali* caste—it is not said if they had been inoculators prior to being entertained as Government vaccinators—in many cases spread small-pox by the practice of inoculation. The latter practice is a more profitable one, and carried on under conditions more congenial and pleasing to the operator than vaccination.

8. Of the total number of 13,388 deaths from small-pox, no fewer than 9,831 occurred amongst children under 12 years of age, and of these 2,805 were under one year. In spite of the prevalence of scarcity and famine, the numbers vaccinated show a substantial increase of 16,574 over the numbers for 1895–96. In the districts in which there was a decrease, the chief causes assigned for this were the inability of the people to pay the vaccinators' fees owing to pressure of hard times, the outbreak of fever, from which the staff of vaccinators, as well as the people amongst whom they were working, suffered, and the lessened numbers available for vaccination in consequence of the unusual number operated on in districts in which small-pox was epidemic during the previous year. The percentage of successful cases rose from 98·39 in 1895–96 to 98·50 in the year under report. The Sanitary Commissioner thinks this ratio incredible, and we are disposed to agree with him. The "dishonest practice" followed by the vaccinators of excluding unsuccessful cases from their returns is not confined to the Province of Bengal. Elsewhere many of the vaccinators at the time of operating write on a slip of paper the names of those vaccinated, and the date on which the operation is performed. When they return to ascertain results they copy the particulars from this slip into the authorised register, omitting the unsuccessful cases. The practice is not easily suppressed, but is not very harmful, especially if the vaccinator repeats the operation in the unsuccessful cases when he comes to ascertain results. Estimating the birth-rate at 40 per mille of the population, the Sanitary

Commissioner calculates that 202·81 per thousand of children under one year of age were protected against small-pox. If Mr. Hardy's estimate of a birth-rate of 51·8 is adopted, this proportion would be reduced to only 149·79 per thousand. Whichever estimate is chosen the proportion is small, and leaves ample susceptible material for the epidemic action of small-pox when that disease breaks out. Animal lymph is superseding humanised lymph in Bengal. Where the former is procurable in sufficient quantity and at a reasonable cost, it removes one of the main difficulties with which the vaccinator has to contend, the difficulty of prevailing on parents to consent to the taking of lymph from the vesicles on their children's arms.

9. *Fever* mortality increased from a ratio, per thousand of population, of 22·99 in 1895 to a ratio of 24·76 in 1896. The ratio for the ten-year period 1886-95 was only 18·83, but this latter was calculated on returns of deaths at a time when registration was much more defective than it now is. As the Sanitary Commissioner observes, it is certain that, under the heading of Fever are included numerous deaths which are really due to other causes. The village watchmen, he says, find it less troublesome to assign deaths to a disease recognised to be everywhere prevalent, and regarding which no further inquiries will be made, than to report them as due to such diseases as small-pox and cholera, outbreaks of which entail constant daily reports and journeys to the police station. Although improved registration may, as suggested, have had some share in the increase of the recorded number of deaths attributed to Fever during the past year, Dr. Dyson writes :—"In a year of abnormal "meteorological conditions such as that under report, when the rainfall was intermittent and the "drying and wetting of the soil alternate, a high death-rate from fever is a natural consequence." The districts in which the disease was most fatal were chiefly those bordering the foot of the Himalayahs, and the "fact that they are more or less subject to the notoriously deadly *Tarai* fever, "probably in a great measure explains the exceptionally high death-rate in them."

10. The scheme for the distribution and sale of quinine continues to make progress. The number of packets of quinine sold during 1896 was 31,867, as compared with 28,530 in the preceding year, or equal to an increase of 1,701,870 grains. The Sanitary Commissioner notices a curious relation which the amount of quinine purchased by the people of the different districts bears to the mortality from fever in those districts. "In Darbangha, where the largest number of deaths occurred, almost the "smallest quantity of quinine was sold. Similarly, in the cases of Muzaffarpur, Gya, and Patna, "where the mortality was high, comparatively little quinine was asked for." Two at least of these districts were severely affected by famine; and as the pressure of hard times was given as a reason why the people were unable to pay to have their children vaccinated, the same reason might perhaps be suggested to explain why they could not afford to buy quinine. Other six districts are mentioned in which there was a large demand for quinine; and the Sanitary Commissioner thinks that "the "demand for quinine is highest in those places where its efficacy is best known and therefore more "generally talked about." The returns bring one significant fact out clearly : the sales of quinine were largest during the months of greatest fever prevalence. Another point noticed in the Government review of the report is that, while the total quantity sold has increased, "there has been a "marked decline in the districts most affected in the failure of the crops." This was no more than was to be expected ; all the money available was doubtless required for the purchase of food, leaving none available for extras.

11. *Bowel complaints* were not unusually prevalent. It might have been expected that an examination of the ratios of mortality due to diarrhœa and dysentery would show these diseases to have been unusually fatal in the districts affected by scarcity or famine. They are of the class of diseases known to be connected with the use of an insufficient or unwholesome dietary. In the districts of the Chota Nagpur Division especially, jungle roots and fruit were largely used in place of grain ; yet, in all of the districts of the Division except one, there is no increase, but some decrease, in the mortality from bowel complaints. In the districts of the Patna Division chiefly affected by famine, the returns show that there was neither marked increase nor decrease of mortality from these diseases.

12. *Sanitary Works.*—Excluding Calcutta, there are 145 municipalities in Bengal, with an income, including the balance from the preceding year, of rather over forty-five and a half lakhs of rupees. Out of this income a percentage of 52·79, or more than half, was expended on sanitary works (original and recurring). Water-supply absorbed nearly ten lakhs, and drainage about a lakh and a half. These sums seem small when what remains to be done to provide so many municipal towns with a good water-supply and efficient drainage is taken into account. Referring to the statement given on page 49, it would appear that, leaving out Calcutta, only seven or eight towns have a pipe water-supply ; whilst still fewer possess an efficient drainage system. In the same statement an attempt is made to show, as far as statistics are available, the influence which the execution of these water and drainage works have exercised on the public health. Unfortunately, the inaccuracy of the statistics of past years renders the statement for the most part inconclusive; but the Lieutenant-Governor in his review of the Report says :—"So far as it goes it shows that the public health "has usually improved where large schemes for the improvement of drainage or water-supply have "been carried out." It should not, however, be overlooked that the two forms of sanitary improvement mentioned are complements of each other; and that their beneficial effects on the public health need not be expected to be very marked until they are combined. The case of Bombay is a good illustration of the need for an efficient drainage scheme to accompany the introduction of a water-supply into a town. The most important sanitary works of the year were "the completion of "the Howrah water-supply, additions to the Serampore and Jalpaiguri drainage works, and the "construction of drains and the improvement of the water-supply at Bhagalpur." The Lieutenant-Governor is gratified to see that the total amount contributed by private individuals rose from Rs. 1,88,875 to Rs. 4,94,131.

13. Dr. Dyson has nothing to add to his remarks in last year's Annual Report on the subject of rural sanitation, except that there has not been much real progress in this direction during the year under review. What measures of improvement have been carried out will be found described

in Annual Form No. II. of Appendix I., a statement which covers 131 pages. An effort is being made by the Sanitary Commissioner to work this lengthy statement into a valuable Sanitary record of each registering area, " but it is a very difficult matter to do so, because the information furnished " by the local officers with regard to defects in drainage, water-supply, and conservancy are so general " and meagre as to be of very little use."

14. During the closing months of the year a panic was created by a report that Bubonic Plague had appeared in Howrah and Calcutta. A Medical Board examined the evidence on which the report was founded, and were satisfied from the clinical symptoms that none of the persons affected were suffering from true Plague. The diagnostic evidence based on the alleged presence of the Plague bacillus in the blood of those affected was shown by Dr. D. D. Cunningham to be worthless.

15. Briefly, the year was one of abnormal meteorological conditions. The rainfall was scanty, unseasonable, and irregular in its distribution. As a consequence, there was serious failure of crops, followed by scarcity deepening in many parts into famine. The short rainfall and great heat caused in many places a scarcity of water. Cholera and fever were both very prevalent, and between them were chiefly accountable for the increase in the death-rate. The Sanitary Commissioner attributes the severity of the cholera epidemic to the insufficiency and badness of the water-supply. Neither small-pox nor bowel complaints were unusually fatal, although the latter are generally intensified by scarcity of wholesome food, and such scarcity widely prevailed during the year. Considerable sums of money were expended on drainage, and in providing good water-supplies for municipal towns. Rural sanitation has made but little progress during the year, a result little to be wondered at when the vastness of the task and the slenderness of the means available for its execution are taken into account. A panic, due to a report that Plague had appeared in Howrah and Calcutta, subsided when it was shown by a Medical Board that the persons affected were not suffering from genuine Plague, and that the evidence on which the report was based was worthless.

12th October, 1898.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-Western Provinces and Oudh for 1896.

The most marked meteorological features of the year were deficient rainfall and abnormally high temperature. The influence of these on the public health is reflected in the vital statistics. Short rainfall was followed by failure of crops, high prices of food, privation and lessened power of resistance to disease. The first half of the year was a period of unusual heat and drought during which the mortality, under the debilitating influence of privation, rose above the mean: the last six months, which should ordinarily be the half of the year of greatest mortality, had its death-rate reduced considerably below the mean, a result which the Sanitary Commissioner, no doubt rightly, ascribes to the unusual dryness which followed the premature cessation of the rains and the consequent decrease of malaria.

2. *Vital Statistics.*—The *births* exceeded the number of those of the previous year by 81,426, giving a ratio per thousand of population of 35·40 as compared with 34·90 for 1895. The latter exceptionally healthy year chiefly influenced the fecundity of the year following it. The number of births exceeded the number of deaths in 1896 by 97,493, this excess representing the natural increase of the population. But, although the birth-rate exceeded that of its predecessor, it was much lower than the decennial mean up to 1890. The Sanitary Commissioner gives the birth-rate calculated on the population numbers of the last census, for comparison with the birth-rate calculated on the population numbers determined by the addition to the census figures of 1891, of the number of births in excess of the number of deaths since that census was taken. Calculated in either way the difference is represented by the fraction 0·75. There are the usual variations in the birth-rates of different districts. The highest rate recorded was 52·76 in Etah, and the lowest, 22·11, in Naini Tal. In municipal towns the variation of the rates was still greater, beginning at a minimum of 26·4 and running up to a maximum of 61·4.

3. The *death-rate* increased from a ratio of 29·13 in the preceding year, to 33·32, but was only higher than the decennial average by a fraction of 0·53. The highest death-rate, 67·40, was recorded in Jhansi, a district which suffered severely from scarcity, fever, and cholera. On the other hand, some of the districts in the east of the provinces, such as Azamgarh, Ghazipur and Ballia, record death-rates of only 22·32, 22·98, and 23·48. The death-rates in towns greatly exceeded those in rural areas, having been for the former 39·11 and for the latter only 32·59. In some of the towns, as for example in Lalitpur and Hardoi, the death-rate was excessive: in the former it was 114·12, and 87·97 in the latter; but it is explained that these rates were swollen by the establishment of poor-houses within the municipalities, and that these attracted persons in an emaciated condition many of whom after a short time succumbed from exhaustion or disease. A table is given comparing the ratios of mortality in the six largest provinces of India. These ratios do not differ greatly in the four provinces of Bengal, the North-Western Provinces, the Punjab, and Bombay. The highest ratio of 34·17 is recorded in Bengal, and the lowest of 31·69 in Bombay. The recorded ratio for Madras is 20·6, an obviously impossible one, due to defective registration. The ratio recorded for the Central Provinces, 49·31, does not err on the side of exaggeration. In all of these provinces, although in varying degrees, crop failure, high prices, and consequent privation prevailed.

The death-rate among children under one year of age in these provinces is given as having been 233·6 as compared with a decennial average of 238·4. Taking into account the health conditions prevailing during the past year, the ratio of deaths amongst infants might have been expected to have exceeded the average.

4. The endeavour to differentiate diseases by a professional agency resulted in the record of 12,633 deaths by persons possessed of some degree of medical knowledge. Of these deaths, 4,727 are recorded as having been due to fevers ; but of this number 4,517 are unclassified. The proportion which deaths from fevers diagnosed by professional agency thus bears to the total number of deaths from all causes, works out to 35·7 per cent. ; whereas the proportion recorded mainly by village watchmen as due to fever is 77·1, or more than double. It follows that, deaths recorded as due to such other diseases as dysentery, diarrhœa, and chest affections constitute a higher proportion of the deaths due to all causes in the returns submitted by professional than in those submitted by unprofessional agencies. This only confirms what was known before, that the village watchman when uncertain as to the cause of death usually records it under the head of fever, and that the numbers under this heading are thus swollen to more than double what they in reality should be. As Dr. Thomson, however, observes with regard to the record of fevers even by professional men, it detracts much from the value of the record to find the bulk of them lumped under the head of " other fevers."

5. Registration of *births* and *deaths* continues to receive much attention. No fewer than 144,049 entries of births and 130,219 of deaths were examined by local district officers. The result was the detection of a percentage of 2·73 omissions of births and of 2·37 deaths from the registers. In addition, 233,027 births and 192,173 death entries were examined by the vaccination staff, who found a percentage of 1·34 of the former and of 0·73 of the latter omitted. The Sanitary Commissioner explains why, in his opinion, the percentage of omissions detected by the vaccination staff is so much smaller than that detected by local officers, and attributes it to the need the former find to be on good terms with the village watchmen, who have it in their power very effectually to assist or obstruct the vaccinators who come to carry on operations in their villages. The vaccinating staff, he thinks, although they do not always report omissions of births and deaths detected in the watchmen's handbooks, generally arrange, in concert with the watchmen, at the time of their inspections, to have the missing entries filled in. The practical result is that registration is improved whilst the vaccination staff do not forfeit the good-will of the watchmen so needful to the success of their vaccination work. Of the value of this system of testing the entries in districts, the comparative accuracy of registration in these provinces is a practical proof. Where such testing is carried out in a perfunctory fashion this is not allowed to pass without notice by the Government. " In the " Mirzapur district, the testing which consisted of an examination of 73 entries was merely nominal " and significant only of failure to comply with the Government orders on the subject."

6. *Chief Diseases.—Cholera* was more prevalent than during the preceding year, yet it cannot be said to have been unusually destructive of life. The number of deaths due to it was greatly exceeded in three of the preceding five years. As usual, the first three and the last two months of the year were those in which the fewest deaths occurred. From having caused only 1,145 deaths in March, it rapidly increased in fatality during April and May until in the latter month 12,480 deaths were attributed to it. In June the number of deaths fell to 9,380, and in July still further to 5,138, again rising to 9,366 in August, and attaining a maximum of 12,926 in September. From this time the disease declined slowly in October, and more rapidly in the next two months, until only 226 deaths were recorded against it in December. It had thus two periods of increase and two periods of decrease during the year. The meteorological accompaniments of this waxing and waning of cholera twice during the season appear to have been as follows :—March was almost absolutely rainless, and the temperature from 2·5 to 3 degrees above the normal. April was very hot, but a considerable fall of temperature occurred about the 18th of the month : it rose again, however, towards the end of the month when it was in considerable excess. Practically, no rain fell anywhere. In May temperatures were everywhere above normal : a little rain fell during this month, but except in the Agra Division the fall was everywhere in defect. Cholera thus attained its first maximum during a period of increasing and abnormal heat, and a period marked by the defect or absence of rainfall. The meteorological features of the period attending the decline of the disease from its first maximum of over 12,000 deaths in May to a little over only 5,000 in July were :—A cool month of June when rainfall was generally in excess of the normal. July was also cool at its commencement : from the 22nd the temperature rapidly rose and was high towards the end of the month. Rainfall was in serious defect in nearly all divisions. During the second rise of cholera in August until it reached its second maximum in September, August was an extraordinarily dry month, and the temperature throughout the provinces was excessive : the light rainfall and the excessive temperature were the general features of the month. In September the mean pressure was above normal, and temperature was much higher than usual : the rainfall for the month was excessively small. During the second decline of the disease—slowly during October and rapidly in November and December—it is stated that October was almost uninterruptedly fine. Of November it is said the temperature was excessive at nearly all stations, and that rain fell on the 21st. In December "the mean temperature of the month was about normal." Briefly, it may be said that the disease attained its first maximum in a period of abnormal heat and dryness ; that it underwent its first decline during a period of rainfall and coolness ; that it reached its second maximum after the cessation of rain and during a period of excessive heat ; whilst it finally subsided during the last three months of the year, the first two of these unusually hot and dry, and the last about normal. The most violent outbreak was in Banda. The Sanitary Commissioner is doubtless right in saying, regarding the consequences of this outbreak amongst the people assembled on the relief works :— " The frightened people adopted a procedure which was probably the best under the circumstances, " and ran away from the infected areas." He adds :—" The water-supply is generally the most active " agent in the dissemination of the disease. In Banda the supply was carefully protected as far as " possible, but water was scanty and the wells were few."

7. *Small-pox and Vaccination.*—From having been in abeyance during 1895, when it was credited with the lowest mortality ever recorded against it in the province, small-pox broke out in widespread epidemic form in the year under review. Whilst only 1,968 deaths were recorded in 1895, the number increased to 42,771 in 1896. This recrudescence of the disease did not come as a surprise. An unvaccinated residuum was known to be accumulating from year to year; and, in accordance with the previous history of small-pox in these provinces, an epidemic outbreak was anticipated. Heavy as the mortality from the disease was, reaching a ratio of 0·91 per mille of the population, it was considerably less than that recorded in 1890, when it was 1·26, and far less than that in 1884 when it was 4·59. Although mortality was greatest, as was to be expected, amongst children, yet a large number of adults succumbed to the disease. In some towns, such as Nehtor with a ratio of mortality of 12·86, and in Aonla of 10·10, the severity with which the disease prevailed leaves little room for doubt that vaccination and re-vaccination are much neglected. The ratio of deaths from small-pox in towns was, however, somewhat lower than in the country, having been in the former 0·86 as compared with 0·92 in the latter. In spite of several circumstances adverse to the progress of vaccination, there was no falling-off in the number of operations, and merely a nominal decrease in the percentage of success in primary vaccinations. The increase in the number of successful primary vaccinations was slight, amounting to only 3,022 cases; but in re-vaccinations it was 16,103. The panic which the outbreak of small-pox causes would account for the greater number of persons submitting themselves to be re-vaccinated. Looking at Statement No. 1 of the Vaccination Report, a noticeable feature of the returns is the surprising percentage of success claimed in re-vaccination. In no fewer than 10 districts, cent. per cent. of the re-vaccinations in which the results were known were recorded as successful; and in the district of Aligarh the percentage is represented as having been 100·57. These figures suggest the need for the exercise of vigilance on the part of the inspecting staff. The mortality from small-pox is not surprising when the returns of vaccination are looked into. Taking the number of births for the province in 1896, and deducting therefrom the number of deaths of children under one year of age, it is found that 1,275,250 remained available for vaccination. Of this number only 578,055 were protected against small-pox by vaccination, leaving an unprotected residuum of 697,195. Examining in the same way the figures for Allahabad, the district in which the highest mortality from small-pox (4·10) is recorded, it will be seen that of a total number of 38,452 children available for vaccination, after deducting the number who died from the total number born, only 9,827 were protected by vaccination, leaving no fewer than 28,625 to feed a small-pox epidemic. Allahabad, the head-quarters district of the Government of the North-Western Provinces, instead of showing an example of enlightenment and progress to the rest of the districts, has ever been one of the most backward as regards vaccination.

8. The ratio of deaths from *Fevers* increased from 23·31 in the previous year to 25·71 in the year under notice. The maximum mortality occurred in December, and the minimum in July. The course of fever prevalence throughout the year is described by Dr. Thomson to have been, with the exception of an increase of the mortality due to it in March, normal until the end of October, although each month recorded a higher mortality from the disease than the corresponding month of the preceding year. After October, the mortality decreased in the following month. "It seems "probable that, on account of the premature cessation of the rains, and the scanty fall, the period of "great fever prevalence had been abbreviated. If this theory is correct, the fall should have "continued through December, but this was not the case; a sharp rise occurred, and the maximum "mortality was recorded in that month." This rise is explained as having probably been due indirectly to scarcity. The privations caused by high prices had reduced the stamina of the people, "and an attack of sickness or fever which would merely have prostrated for a few days a well-fed "person, often proved fatal to an individual imperfectly supplied with food. Cold and wet, too, "would be serious foes to people with little to spare for the purchase of warm clothing—especially "as regards the very young and very old." It is added that most cases of pneumonia would be returned as fever: this has been found to be the case during the cold season in other provinces.

9. Regarding the prevalence of *Bowel-complaints*, it is remarked that there was nothing peculiar, except a rise of mortality from these diseases in December. This rise was only what was to be expected during a time of scarcity of wholesome food. Diarrhœa and dysentery are the almost invariable concomitants of insufficient or unsuitable diet. For the year as a whole, however, the mortality from these two diseases was somewhat less than during the previous year.

10. *Sanitary Works.*—An account is given of the amount and quality of the water supplied during the year to the towns provided with water-works. Generally speaking, the quality of the water was "good." With regard to Allahabad, it is stated, "the supply was generally good, but twice it was "reported that the enteric microbe had been detected in the filters." It is added, "the contamination "was temporary and accidental." A similar case of temporary impurity of the water supplied to Meerut is noted. "The character of the supply is good, though on one occasion, through careless "working of a filter, the number of microbes rose to 3,000 per cubic centimetre." The only new water-works completed during the year were those at Meerut. A statement is given with the object of attempting to show, from vital statistics, the influence on the public health of the introduction of water supplies and drainage systems. It cannot be said that any satisfactory conclusion can be arrived at from an examination of these statistics. Taking the figures on the portion of the statement on pp. 32–33, it will be seen that in rather more than half the number of circles the death-rate shows an increase, and in rather less than half a decrease, since the introduction of a drainage system or water-supply or both. The statement includes a long list of circles in which works of comparatively trivial importance have been carried out; and the Government point out that the statement "should "be confined to large and important works, the construction of which is likely to have a distinct "effect upon the public health." With regard to minor sanitary works, the Lieutenant-Governor also observes that the account given of the measures taken for the sanitary improvement of different places in column 14 of Form No. II., makes it scarcely necessary to give the details shown in paragraphs 78–180. The omission in future of these paragraphs, or better still, the abridgement of Form No. II., will considerably shorten the Report, and lessen the labour of preparing it.

11. Sanitary progress during the year was restricted by the need for employing the ordinary Department of Public Works Establishment in organizing and superintending works in connection with the relief of distress, as well as by the want of funds due to the heavy expenditure on famine relief. The Sanitary Commissioner thinks that, by far the most important measure taken during the year as regards sanitary progress was the issue of the Government Resolution reconstituting the Sanitary Board of the province. This resolution "converts what was practically merely a consultative "body into one with definite powers and funds at its disposal, and places the Department on a sound "scientific basis. It cannot fail to make for good." There is no doubt that, if a sufficiency of funds is placed at the disposal of this Board, sanitary progress will be accelerated. It will, however, perhaps be best to wait for results before expressing a too sanguine prediction regarding the influence which the resolution is likely to exercise on sanitary progress. The wisdom of the instructions given to the Board in the ninth paragraph of the resolution will be questioned by no one possessed of a practical knowledge of sanitation in rural India :—"But here it may be said, for the Board's general "guidance, that they should discourage rules and works which are not of a simple character. No "attempt should be made to introduce the latrine system, and what is done, or attempted to be done, "should be unpretentious, agreeable to the feelings of the people and in general harmony with "existing village practice." If these instructions are attended to, no change of a sudden or revolutionary nature in village sanitation is likely to follow the issue of this resolution, the importance of which the Sanitary Commissioner thinks "it is almost impossible to overrate."

12. *Summary.*—As in most other parts of India, the rainfall in the North-Western Provinces and Oudh was scanty and irregular. Failure of crops, more or less complete, followed; and the poorer classes underwent, in extensive tracts, much privation. But for the timely relief given by the State the mortality due to want of food would, in some districts, probably have been considerable. In spite of State aid, it was inevitable that numbers should have their powers of resistance to disease weakened by privation. Prices of grain compared with the mean of the previous year, when they were also high, rose from 17·3 to 12·7 *seers* per rupee. Cholera and small-pox were more fatal than in 1895, the former disease showing two periods of rise and fall during the year. Fevers were also more fatal, partly owing to the vital stamina of the people having been lowered by privation. The need for the employment of the ordinary staff of the Department of Public Works on duties connected with famine, and to the diversion of funds towards famine relief, retarded sanitary progress. A Resolution issued by the Government reconstituting the Sanitary Board and giving it executive in addition to consultative power is regarded by the Sanitary Commissioner as a measure the importance of which on sanitary progress it is almost impossible to overrate. The remarks on sanitary defects and the remedies taken for their removal given in Annual Form II. are concise and to the purpose. The Lieutenant Governor thinks they render the details given in paragraphs 78–180 scarcely necessary, an opinion with which we agree.

12th October, 1898.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1896.

The climatic conditions, like those of the previous year, were favourable to health. The rainfall was much below the average for the previous 10 years. As a result, although the crops suffered and prices rose, especially towards the end of the year, causing much privation amongst the poorer classes, yet, owing to the diminished prevalence of malarial diseases accompanying unusual dryness of the last months of the year, the death-rate rose little above the rate for the preceding very healthy year of 1895.

2. *Vital Statistics.*—Although the number of births was less by 16,892 than in the preceding year, the *birth-rate* was the highest recorded in any Province of India. Calculated on the census population of 1891, it was 43·04 per 1,000, or a fraction below the ratio for 1895. But high as this rate is, it is still below the actual rate. In some of the frontier districts registration, as shown by the returns, continues to be very defective. In the Peshawar and Hazara districts examples are given of birth-rates being returned by police circles of 11·6 and 17·2 per mille of population. The recorded proportion of 110·1 male to every 100 female children born is high; but tends to diminish with the improvement of registration. Where, as in the Peshawar and Kohat districts, rates of 136·9 and 123·2 males are recorded against every 100 females born, registration is very backward. The excess of births over deaths was 236,593: in other words the population of the province increased by this number or at the rate of 11·5 per mille. Such rapid increase may be taken as an indication of growing prosperity accompanying extension of irrigation and cultivation of hitherto waste land; but if its unrestrained continuance ultimately tends to the conversion of the Punjab into an overcrowded province, of which Oudh, Bihar, and other parts of India may be taken as examples, the prospect can scarcely be regarded with unmixed satisfaction.

3. There was an increase in the *death-rate* from 29·29 in the preceding year to 31·53 in the year under notice, due in part to a severe epidemic of small-pox. As the birth-rate was higher than that of any other province in India so was the death-rate lower, if we except Madras, in which an impossible rate of 20·6 is recorded, and which need not, therefore, be taken into account. The rate varied between 40·9 and 40·4 in the Umballa and Karnal districts, and 23·4 and 22·9 in Gujrat and Dera Ghazi Khan. According to age, the ratios of deaths per 1,000 living were 229·14 of male and 223·32 of female children under one year. "The districts of Jullundur, Ludhiana, Amritsar, and

" Ferozepore, particularly the first two, show an excess of female over male infant death-rates. " Measures are now being taken to prevent the practice of infanticide or deliberate neglect of female " infants in these districts." One of the uses of accurate registration of vital statistics is to attract attention to such discrepancies as those shown to exist between the number of male as compared with the number of female children dying in some districts, and to lead to inquiry being made into their causes. The case of the four districts named also suggests the need for caution in hastily assigning to defective registration anomalies in vital statistics which may have an altogether different explanation.

4. Registration of births and deaths continues to receive much attention in the Punjab, with the result that the ratios of both approach nearer than those of most, if not of all, other provinces to the ratios estimated by actuaries. That there is still room for improvement, however, even in the Punjab, is clearly shown by the results of the testing of entries in the village registers. In 15,111 villages, the registers of which were tested by the Tahsildars and their assistants, 2,089 omissions of births and 1,202 of deaths were discovered. In 338 villages in one district, and in 716 in another, only one omission was discovered by these officials. Regarding this, the Sanitary Commissioner truly remarks :—" Such superficial inspection of the registers is useless." From the registers of 28,444 villages the vaccinators found that 13,326 entries of births and 3,420 entries of deaths had been omitted ; and, the omissions discovered by Divisional Inspectors were still more numerous : these latter discovered that 6,925 births and 3,733 deaths had not been recorded in the registers of the 3,242 villages visited by them. These figures indicate that the duty of testing the accuracy of those registers is carried out with very different degrees of thoroughness by the several agencies employed. Whilst Tahsildars discover only one entry omitted, on the average, from the registers of every five villages inspected, the vaccinators discover one in about every two villages ; and the Divisional Inspectors three in every village inspected by them. Were the only mode of inspecting which can be regarded as effectual, a house-to-house inquiry, carefully carried out, it is more than probable that the number of omissions discovered even by the Divisional Inspectors would be found to be below the reality. But house-to-house inspection takes more time for its efficient performance than hard-worked district officials can bestow. There were 70 persons fined for neglecting to register births and deaths in the municipal towns of the Punjab during the year.

5. *Chief Diseases.—Cholera* was credited with 5,146 deaths, or a ratio of 0·25 per thousand of population, as compared with a mean of 0·85 for the previous five years. With the exception of a single case taken from the train at Ludhiana in April, no case of the disease was reported in the province before the month of May. In the Eastern districts which lie next the North-Western Provinces a few cases occurred in the beginning of May. On the 17th of that month, a severe outbreak of the disease took place in the Rawal Pindi district. Up to the 17th of May, 70 cases had been reported by the Civil Surgeon, who states that "all cases had contracted the disease at the " Nurpur fair." Dr. Bamber could not ascertain how the disease came to the fair ; but says that one of the first cases was a sweetmeat seller, and that he suspected this man spread the disease. The Sanitary Commissioner himself visited Nurpur on the 9th of April, more than a month before cholera broke out there. After describing the mountain stream which usually supplies the place with drinking water, and remarking that it had failed to a considerable extent on account of the dry weather, he says :—" Given a single case, therefore, of cholera in one of the pilgrims and knowing " the habits and customs of the people at wells and watercourses, the epidemic here resolves itself into one of water-poisoning in a wholesale manner." The conclusion thus drawn rests on the assumptions that there was a case of cholera in a pilgrim who visited Nurpur, that this pilgrim infected the water-supply, and that the water-supply spread the disease. The assumptions are neither far-fetched nor unreasonable, but they rest on no basis of ascertained facts.

6. Experiments were continued with the view of testing the protective value against cholera of disinfection of wells by lime, permanganate of potash, and alum. These experiments were carried out in every district in which the disease appeared, and the Sanitary Commissioner writes :—" From " every district where disinfection was tried, the opinion of the medical officer is distinctly favourable " to the system, and in several places the villagers themselves begged to have it carried on when they " saw the results which followed." Such opinion is valuable, and it is supported by the opinion of medical officers in other provinces. At the same time, further experiments, and those conducted in accordance with scientific methods, are required to show in what way and to what extent these agents act in putting a stop to cholera by destroying its cause in drinking water.

7. The year was characterised by a severe epidemic of *small-pox*, which carried off 45,084 people. The death-rate from this disease was equal to 2·19 per thousand of population, a rate which has not been exceeded since 1879, when it was 2·83. There was nothing remarkable about the progress of the epidemic except its unusual severity. It was a continuation of the epidemic which prevailed in the previous year, during the last month of which no fewer than 2,088 persons were carried off by it. As usual, the mortality increased through the hot months until it attained its maximum in May, after which it declined, until it reached its minimum in September. During the last three months of the year it again showed a tendency to increase. As might have been anticipated, the districts which enjoyed the greatest immunity during the epidemic were those, such as Kangra, in which vaccination of the population is the most complete. Accompanying this severe epidemic of small-pox it is disappointing to find from the returns that there was a decrease instead of, as might have been expected, an increase in the number of persons vaccinated during the year 1896-97. The falling-off was chiefly in primary operations ; but under the head of re-vaccination there was also a slight decrease. Ordinarily, an epidemic of small-pox acts as a stimulus to vaccination and more especially to re-vaccination. In the Punjab it would appear to have had an opposite effect. The Vaccination Report has been effectively reviewed by the Government of the province, and, more briefly, by the Government of India ; and it is conclusively shown that the prevalence of scarcity, and of small-pox, and of emigration assigned by the Sanitary Commissioner and the Civil Surgeons as the causes of the decrease in the number of vaccination operations could have had little or

no share in bringing about such a result. At least one of these assigned causes, the prevalence of small-pox, should have had the opposite effect of giving a stimulus to vaccination. In Appendix A. of the Vaccination Report, some statistics are given to show the comparative efficiency of the different descriptions of vaccine lymph used by the special staff during the year. From the figures given in Table No. II. of this Appendix, it appears that human lymph gave considerably the best result, that buffalo-calf lymph came next in degree of success; and that lymph preserved with vaseline was the least successful of the three kinds used. Whilst the percentage of success given by human lymph was 99·09, that given by vaseline lymph was only 95·66. The points discussed in paragraph 10 of the Appendix already referred to are of importance, and raise the vital question of the efficiency, or otherwise, of the protection against small-pox conferred by vaccination with vaseline lymph. Dr. Hunter says:—"It has been objected that the scars after vaccination with vaseline lymph do not "usually present that pitted appearance which some people maintain as the test of a good "scar and efficient protection." No time should be lost in proving, beyond any possibility of question, that the opinions of those "people" are groundless, and that the protection conferred against small-pox by vaccination with vaseline lymph is as thorough and lasting as that following the use of lymph taken direct from the calf or from the arm. Persons vaccinated with vaseline lymph which has not left behind it the pitted or "foveated" scar hitherto generally considered to be characteristic of genuine vaccination, might be subjected to the test of a subsequent operation performed with fresh calf or human lymph: if they failed to respond to either of these, some confidence might be felt in the efficiency of the vaseline lymph. But whatever test or tests may be employed, there should remain no shadow of suspicion regarding the protective efficiency of the lymph used for vaccination.

8. Nearly the same number of deaths occurred from *fevers* as in the preceding year. The ratio of deaths per 1,000 of population from this cause was 19·15 in the year under report, and 19·08 in 1895. Both years much resembled each other in their climatic features, having both been unusually dry, and both characterised by low death-rates from fever. Ordinarily, the last months of the year are those of greatest fever prevalence; but the last months of 1896, the driest year on record, enjoyed an exceptional immunity from malarial diseases. Contrary to experience, the month of January showed the greatest mortality from fever, no fewer than 61,134 deaths having been attributed to it, or nearly twice the number recorded as due to it in any other month of the year. In explanation of this transference of highest fever mortality from the end to the beginning of the year, the Commissioner writes:—"This curious fact appears to be "due chiefly to erroneous classification, for, from personal experience of the province, I feel "satisfied that the majority of deaths reported in January as due to fevers were really caused "by pneumonia and chest complaints."

9. *Bowel complaints* were, as in the case of fevers, less fatal than usual. The diminished mortality from bowel complaints and fever, which characterised the vital statistics of the two successive years 1895 and 1896, is attributed to the unusual dryness of both.

10. *Sanitary works.*—The income of municipal towns for the year amounted to upwards of forty-one lakhs; and the expenditure to over forty-three lakhs. Of the latter sum, nearly six lakhs were expended on conservancy, over a lakh and a quarter on drainage and sewerage, and over a lakh and sixty thousand on water-supply. Considerable activity seems to have been shown in carrying out drainage and water-supply schemes. Part I. of the Delhi Drainage Scheme was completed; whilst schemes for Lahore and other towns are in progress. A scheme for draining the flooded area of the Karnal district was undertaken, and other drainage works of greater or less importance were under consideration or had been sanctioned. Of waterwork schemes, those at Delhi and Umballa were completed, as well as others at Haripur, at the Umballa District Jail, and at Simla.

11. A statement is given with the object of endeavouring to show, by the vital statistics of towns and rural circles, the effect on health produced by the introduction of drainage systems, or water-supplies, or both. Dealing only with towns, it is seen that, of the 17 mentioned in the statement, the death-rate had diminished in seven, increased in eight, and remained the same in the other two. Dr. Roe endeavours to explain these unsatisfactory results. It is unquestionably true that, as he says, "It takes time to accustom the people of any town to the "use of pipe water, and at no time do the people, as a whole, use it exclusively." Under such circumstances it is certain that the influence of water service on health cannot fully be determined. "Another reason," he continues, "seems to be the tendency of late years for the "population to increase in the towns, while the accommodation remains practically the same, "thus leading to overcrowding, and personally I am inclined to consider, in great measure, this "influence as the chief factor in producing the very indifferent results hitherto obtained." Defective registration of vital statistics might be added to the other possible factors concerned in producing these indefinite results. In many towns in other provinces improvement of registration of births and deaths is making steady progress, with the result that, although the actual number of deaths may remain the same or even decrease, the recorded number increases. Improvement in the health of towns which vital statistics would show if registration were accurate, might in this way be masked, or might even be made to appear as deterioration.

12. Village inspection books are being introduced into selected villages. If properly kept up, "it "is hoped that in the course of years they will prove useful in giving important sanitary information "to inspecting officers at the time of their visits to the villages."

13. *Summary.*—The year 1896, like its predecessor, was healthy. Both years resembled each other in being exceptionally dry. Deficient rainfall was followed in some tracts of the province by failure of crops, high prices, and considerable privation amongst the poorer classes. But the healthy characteristics of the year more than counterbalanced the injurious effects of privation on the

death-rate, which remained below the average mean of the previous five years. Registration of vital statistics continues to receive much attention. The birth-rate was the highest, and the death-rate the lowest, recorded in any of the larger provinces of India excepting Madras; and in Madras the vital statistics are so defective as to be useless for purposes of comparison of its health conditions with those of other provinces. Cholera was not excessively fatal, and the mortality from fevers and bowel complaints was much the same as during the preceding very healthy year. But a violent epidemic of small-pox swept off upwards of 45,000 people, demonstrating in an unmistakeable way that the protection conferred upon the population by vaccination is still very incomplete. Considerable activity was shown in the prosecution of sanitary improvements. The endeavour made to show from vital statistics the influence on the health of the people exercised by drainage schemes and the provision of water supplies, failed to lead to any definite conclusion.

12th October, 1898.

No. 5.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1896.

A table is given at page 14 of the report, showing the meteorological and mortuary statistics together with the prices of food-grains for the year in four districts; but we are cautioned not to place too much reliance on indications which this table may seem to afford whilst registration is so defective. It would have been more useful had the Sanitary Commissioner devoted a paragraph to a description of the general meteorological features of the year; to a brief account of the character of the harvests, whether they were abundant or deficient; to a comparison of the price of food-grains with their prices in former years; and to an expression of his opinion as to the influence which these factors exercised on the health of the province.

2. *Registration of vital statistics* continues to receive much attention. That improvement proportionate to this attention has followed is made clear by an examination of the table given on page 8 of the report. From this it will be seen that the recorded birth-rate, which in 1872 was only 17·79 per mille of population, has risen to 32·27 in the year under review; whilst the death-rate within the same period has risen from 12·48 to 23·63. It is pointed out that the ratios of both births and deaths recorded for 1896 are calculated on the census figures of 1891; whilst the increase in the population of the province since the latter year must have been considerable. The consequence is that the ratios are somewhat higher than they would be if calculated on the actual population numbers of 1896. But after making full allowance for this source of error, which probably would not affect the results to more than a fractional degree, the improvement has been marked. It is doubtful if, in Burma, the agencies available for the work of registration are capable of being made so efficient as those in some of the provinces of India. In these latter, the village watchmen record the births and deaths on the spot, and periodically take the record to the police station for entry in the register of the circle. In Burma the headman of a village, or of a town ward, is probably not so well-disciplined or so much under control as a salaried watchman. But after all, the method of working a system is often more important than the system itself. The Lieutenant-Governor truly remarks:—"Deputy Commissioners should give "Civil Surgeons every assistance in inquiring into every case in which the rates of births or "deaths are considerably higher or lower than the average of the surrounding circles. Unless "the headmen and police believe that the Deputy Commissioner is interested in the matter "they will not take any trouble about it." The report is replete with evidence that strenuous efforts are being made to improve registration, the importance of which is fully recognised. As the Government of India, in their review of the report, observe:—"An efficient system "of registration is the surest basis of sanitary improvement and the only reliable warning against "the danger of epidemic disease."

3. The recorded *birth-rate* was 32·27 per thousand of population, as compared with 29·04 in the preceding year, and with a mean of 25·65 for the previous five years. The increase is doubtless due in some degree to the increased population numbers of 1896 as compared with those of its predecessors; but it is probably the result mainly of the omission of a smaller number of births from the registers. The proportion of male to female children born was, for the province, 107 of the former to 100 of the latter; but there are striking variations in this proportion in the different registration circles. The Sanitary Commissioner observes:—"Disparity in the sexes "is usually less pronounced in the circles returning the highest ratios of births." This may be interpreted to mean that where registration is approximately accurate the numbers of male and female children born more nearly approach each other. So constantly is this true, that the degree of divergence or approximation in their numbers may generally be taken as some measure of the accuracy or inaccuracy of the registration. The number of males born to every 100 females varies from 149 in one registration circle to only 71 in another; in the former the recorded birth-rate is 28·09, and in the latter 25·65. Unless special conditions exist in these circles which would account for these low ratios, it would to fair to estimate their actual birth-rates at over, rather than under 40 per thousand of population.

4. The recorded *death-rate* for the province was 23·63 per thousand of population. Except as marking improvement in registration and indicating how much remains to be done before approximate accuracy of the returns can be attained, these figures cannot be regarded as possessing much value. On the contrary, they are apt to be misleading. An attempt is made, in compliance with the orders of the Government of India, to show from vital statistics the influence which the introduction of a drainage system, or water-supply, or both, into towns has exercised on the health of those towns. It is obvious that, if introduced at a time when registration is so defective that little more than half the number of deaths are recorded, the drainage system and water-supply, instead of diminishing, may appear to increase the death-rate as the registration becomes more complete and fewer deaths escape record.

5. *Cholera* is credited with having caused 2,959 deaths during the year. A map is attached to the Report, showing the tracts of the province affected, as well as a statement purporting to record the dates on which the first and last deaths from the disease occurred in the several registration circles and towns. In towns, some reliance may perhaps be placed on these dates, but in rural circles, taking into account the agencies furnishing them, anything like accuracy can hardly be looked for. The Sanitary Commissioner might in future reports briefly describe the conditions which may appear to have influenced the outbreak and spread of cholera, and the effect of the measures, if any, adopted to arrest its progress. In some of the provinces of India much benefit is claimed to have followed the purification of the water-supply by permanganate of potash and other chemical agents. It would be useful to have some record of the experience collected in Burma regarding the influence which the water-supply seems to exercise on cholera prevalence.

6. *Small-pox and Vaccination.*—The number of deaths recorded as due to small-pox was only 814, which gives a ration of 0·37 per thousand of population. In Rangoon city alone, 275 of these deaths were recorded. The propagation of the disease in Burma is supposed to be connected with the immigration from India of unprotected coolies; and proposals for remedying this evil are under consideration. Perhaps the remedy might be found in a measure for securing the vaccination of the coolies at the time and place of their recruitment, or at all events before they land in Burma. Vaccination throughout the province generally, made satisfactory progress. In lower Burma alone, there was an increase in the number vaccinated of 45,536 over the numbers of the preceding year. This increase was entirely under the head of primary vaccination. Of re-vaccination, there was a decrease of 6,142 cases. In Rangoon town the decrease in the number of primary vaccination and re-vaccination operations together, amounted to 14,754 cases. Taken in connection with the fact that upwards of a third of the total number of small-pox deaths recorded in Lower Burma took place in Rangoon town alone, this falling-off in the number of vaccine operations is suggestive. The cause assigned by the Health Officer to account for this decrease may be shortly restated. The President of the Municipal Committee in August last prohibited "the compulsory adult vaccination which "generally contributes by far the largest proportion of operations." As a result, practically no vaccinations were performed on adults for the remaining seven or eight months of the official vaccination year. The President's order was based on the death of a *mali* of the German club from tetanus following vaccination, and which was supposed to be a complication of the operation. The Health Officer, it is added, does not admit that "tetanus was due to vaccination." The sequel is thus described :—"The President's order has produced such a scare in the popular mind that, notwith-"standing all the efforts on the part of the vaccinators, no adult coolies, who keep constantly pouring "into Rangoon in large numbers, could be persuaded to submit to the operation." The consequences of the President's action will not be limited to the decrease of vaccination and the increase of small-pox in Rangoon. These unprotected adult coolies will prove a source of danger not only to the port in which they land, but to whichever part of Burma they migrate. Regarding the vaccination of infants, the Sanitary Commissioner considers the results to be so far satisfactory. The number vaccinated in excess of that of the preceding year was 22,753. But if the estimate that 127,561 children under one year were available for vaccination is approximately correct, and only 63,484 infants were successfully vaccinated, it follows that slightly more than half remained unprotected against small-pox. In both primary vaccination and in re-vaccination, the percentages of success were higher than during the preceding year, those of the former rising from 91·21 to 92·01, and those of the latter from 46·01 to 58·79. A separate account is given of vaccination in Upper Burma : this is inconvenient; and the Lieutenant-Governor directs that in future reports the two parts of the province should be treated together, and the statements concerning them should be amalgamated. The progress of vaccination in Upper Burma continues to be satisfactory. The total number of persons vaccinated rose from 115,703 in 1895–96 to 126,464 in the year under report; whilst in primary vaccination the percentage of successful cases was 93·34, and in re-vaccination 64·64, as compared with 92·67 in the former, and 66·65 in the latter during 1895–96.

7. The number of deaths from *Fever* is the highest ever recorded. This need not be taken to imply that the disease was unusually prevalent and fatal, but merely that the registration of deaths from this, the principal cause, as from the other causes of mortality is year by year becoming more complete. The scheme for the sale of quinine, which has been working for rather more than a year, has not, it is stated, quite achieved the success that was hoped for. Suggestions are offered with the object of diffusing more widely a knowledge of the value of quinine, and of how and where the drug may be obtained, in the hope that its purchase may thereby be stimulated.

8. The Sanitary Commissioner makes some interesting remarks regarding the influence of water-supply on the prevalence of diarrhœa and dysentery. After giving a list of towns with the highest ratios of deaths from these diseases, he adds :—"Some of these towns get their water-supply from "rivers, some partly from rivers partly from wells, and some have to rely on wells entirely. No "relation between these various sources of supply and the incidence of bowel complaints is "discernible, nor can any be traced in the sanitary defects or in meteorology."

9. *Sanitary works.*—No Sanitary work of importance was undertaken during the year, although some preliminary surveys and experiments were carried out with a view of arriving at a decision

regarding the kind of schemes most suitable for adoption. In Burma, as in every other province, the want of funds stands in the way of sanitary improvement. "Government is unable to lend money " this year to municipalities except for plague suppression and famine relief purposes." The account given of the sources from which Rangoon is supplied with water, if not overdrawn, suggests urgent need for their protection against pollution. "The water from the lakes has been unfavourably " reported on by the Chemical Examiner and is not passed through any filter beds." Further, it is stated that " on the edge of Victoria Lake there is a water-closet, and about 200 feet further there are " three villages. About 300 feet from the Royal Lake's high-water mark are situated residences " with water-closets &c."

10. Sanitary inspection registers have been introduced into nearly all headquarters of townships and subdivisions; but it does not appear that much has yet been done towards the filling up of these registers with such remarks on the sanitary condition of the towns and villages in which they are kept as might serve as a useful permanent record. The extension of this system of sanitary record to the country generally, although certainly desirable, must, from the vastness of the area to be dealt with, and the limited number of agents possessed of the knowledge needful to enable them to make a useful inspection and to record its results, be a question of time. "The labours of the Sanitary " Board appointed in 1888 continued to be barren, but the appointment of a Sanitary Engineer for " the province in November next will doubtless afford useful material for their deliberations." Such is the verdict passed on the Board by the Lieutenant-Governor.

11. Briefly, strenuous efforts are being made, and with marked success, to improve the registration of vital statistics. The Lieutenant-Governor impresses on Deputy Commissioners the importance of their earnest co-operation in the endeavour to accelerate this improvement. The recorded birth-rate was 32·27, and the recorded death-rate 23·63 per mille for the province; and, although these rates are undoubtedly still much below the reality, they indicate a great improvement in registration as compared with the figures for 1872, when they were respectively 17·79 and 12·48. Cholera was not unusually fatal. It would have been useful if the Sanitary Commissioner had given some account of the conditions which seemed to influence the progress of the disease, and especially some account of the water-supply in the affected areas; also, if he had stated whether any measures were adopted with the object of cutting short outbreaks of the disease and if these measures proved successful. Small-pox did not prevail in severe epidemic form. A large proportion of the deaths occurred in Rangoon town—a result attributed by the Health officer to the action of the President of the Municipal Committee in prohibiting the compulsory vaccination of adults, in consequence of a native having died of tetanus following vaccination. Except in Rangoon, vaccination made satisfactory progress. The mortality ascribed to fever was the highest hitherto recorded in the province, a result probably due to improved registration rather than to greater prevalence of the disease. No sanitary works of importance were undertaken during the year, although preliminary surveys and experiments were carried on with a view to works being put in hand so soon as a sufficiency of funds should become available.

12th October, 1898.

No. 6.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Central Provinces for 1896.

In his remarks on the Annual Sanitary Report for 1895, the Chief Commissioner expressed a fear that the year 1896, like its predecessor, would also show a falling off in births, "the series of bad " harvests not having yet been broken by a cycle of prosperity." This fear was fully realised. The year under notice proved to be one of remarkably abnormal conditions. Owing to the premature cessation of the rains in 1895, succeeded by a rainless cold and hot weather up to the setting in of the monsoon, the spring crops failed in all except a few districts. It was hoped that the monsoon of 1896, when it did set in, would at length put an end to the hard times and privation from which the people had suffered during the preceding years of bad harvests. Until the end of August the monsoon was favourable and everything gave promise of an abundant autumn crop; but again were these hopes disappointed—the rains ceased early in September, and under the influence of the succeeding heat and drought this promise of relief faded away. Prices rose to such a height as to be beyond the means of people already reduced to poverty by a continued succession of crop failures, and before the end of the year the greater part of the Provinces was in the grip of a calamitous famine.

2. *Vital Statistics.*—The *birth-rate*, which in 1895 was the lowest recorded within the previous 15 years, further decreased during the year under review and stood at 31·72 per mille of population, as compared with a decennial mean of 40·66 for the period 1882–91. Up to the year 1894 the birth-rate was fairly constant, and fell little below what may be assumed to be its normal ratio of somewhat over 40 per thousand of population. That the diminished prosperity accompanying or following a succession of bad harvests should be reflected in diminished fecundity was no more than was to be expected. In one only of the 18 districts of the Central Provinces did the number of births exceed the number of deaths. This district, Sambalpur, is practically outside the area affected by scarcity, a fact which tends to confirm the conclusion that the decrease of the number of births was mainly, if not entirely, due to the failure of the crops in the rest of the Provinces, or to the conditions of privation and distress resulting from such failure.

3. As the birth-rate diminished under the adverse influences of scarcity in 1895 and the first months of 1896, so under the operation of the same influences the *death-rate* greatly increased. The deaths exceeded in number those of the previous year by no fewer than 119,332; and the ratio per mille of population rose from 36·75 to 49·31. This is the highest death-rate recorded during the preceding decennium. In 15 of the total number of 232 registration circles the death-rate exceeded 90 per thousand of population. The highest ratio recorded was 172·21 in the Damoh circle of the Damoh district.

4. "It is remarkable," writes the Chief Commissioner, "how closely the maximum falling-off in "the birth-rate corresponds with the area of maximum harvest failure and consequent distress. It "would seem that a markedly short birth-rate may be accepted as almost conclusive evidence of the "prevalence of pressure on the labouring population." The districts in which this decrease of the birth-rate was most marked are at the same time those in which the death-rate was above the provincial average of 49·31; they are also the districts in which "distress culminating towards the "end of the year in acute famine was prevalent." On the other hand, the only district in which the birth and death-rates were practically normal was that of Sambalpur; and in this, distress due to scarcity did not exist. Whatever other conditions therefore may have been concerned in bringing about increase of the death-rate and diminution of the birth-rate during 1896, it may be accepted as certain that none was equal in importance to privation and distress due to scarcity of food.

5. In accordance with past experience, the incidence of a scarcity and famine was most severely felt by the feeblest part of the population. Children under one year of age died at the rate of 318·14 per mille of the number born in 1896, as compared with a rate during the preceding year of 259·89. "The increase in the death-rate among infants," writes the Sanitary Commissioner, "corresponds "with a decrease in the number of births registered due to the effects of extreme privation retarding "the natural growth of the population." The death-rate amongst the very old was at the same time high.

6. Although the mortality was greatest, as usual, in the months succeeding the rains, each month of the year "was characterised by a death-roll higher than in the previous year." The high death-rates of August, September, and October were due chiefly to the prevalence of malarial diseases acting on constitutions enfeebled by privation.

7. A comparison of them shows that, taken for the whole Central Provinces, there is no very marked difference between the vital statistics for the rural and those for the urban population. The death-rate in towns in which registration was compulsory exceeded by 1·46 per thousand of population the rural death-rate; and the urban was less than the rural birth-rate by 1·07. The enormous death-rates of some of the towns, such as Damoh, are said to have been due in part to the influx from bordering Native States of "emaciated and moribund immigrants."

8. The table given at the foot of page 5 of the report compares the ratio of deaths in accordance with class. The remarkable difference between the death-rates amongst Hindus and Mahomadans, and those recorded for "other classes," is not explained by the Sanitary Commissioner; but in his review of the report the Chief Commissioner writes:—"It is a noticeable feature of the mortality of "the year that one-quarter of the deaths registered, or 122,662, were of 'other classes,' under which "denomination the aboriginal and jungle races are chiefly included. The per millage rate to the total "of these classes was 87·34 against 42·69 Hindus and 43·12 Mussalmans." It is the general experience that owing to their shy, suspicious character, and the natural difficulties of the hilly and forest tracts in which they live, these tribes cannot be so effectually relieved during times of scarcity as the more civilized inhabitants of the plains. Rather than do any regular work, or accept aid in the form of grain or even of money, many of them prefer to subsist on forest roots and fruits until they have become so reduced that, when at length provided with a sufficiency of wholesome food, their restoration to health is found to be hopeless. Needless to add, the mortality amongst such tribes during the prevalence of scarcity or famine is sure to be great.

9. *Chief Diseases.*—Famine is usually, although not invariably, accompanied or followed by pestilence. During 1896, scarcity deepening into actual famine reduced the resisting powers of the people, and thus prepared the way for the destructive effects of disease. To *cholera* alone 52,985 deaths, equal to a ratio of 5·58 per mille of population, are attributed. Only once during the previous ten-year period has this number been nearly approached. The disease prevailed in every one of the 18 districts, but as a rule proved most fatal in the districts in which distress arising from scarcity was most acute. In the northern districts of the Provinces it was especially prevalent and fatal. In one of these, Mandla, the ratio rose to 15·75 per mille. In one of the north eastern districts, Bilaspur, it was 10·99. On the other hand, in Sambalpur, in which there was no scarcity, the ratio was only 1·73. In four other districts the ratio was under 2 per thousand of population. In all of these four there was failure of crops, and greater or less scarcity. It thus appears that, although the prevalence of cholera bears some proportion to the degree of distress in most of the districts, this proportion was not a constant one. From a minimum of 29 deaths in January, the number increased month by month until the maximum of 14,000 was reached in June. From the latter month the number of deaths decreased, until in November they had fallen to 143. "The exceedingly dry and hot spring "and summer was the season of the greatest prevalence of cholera, which reached its maximum in "April (8,407 deaths), May (12,935), and June (14,000). The scanty and foul water-supply, which "was the natural result of the drought, may reasonably be supposed to be also the main cause of the "cholera, which, besides the above districts (those of the Jabalpur division), was particularly "prevalent in Bilaspur and Raipur districts, which rely for their water-supply upon tanks formed by "impounding the surface drainage."

10. Consequent upon a sudden and severe outbreak of cholera which occurred amongst a number of officers who had dined together at Saugor on the evening of the 13th July, Mr. Hankin, the Bacteriologist to the Government of the North-Western and Central Provinces, accompanied by the

Sanitary Commissioner of the Central Provinces, made a bacteriological inquiry into the cause of the disease. "After inquiry, Mr. Hankin was of opinion that the fish caught in the Saugor Lake and "brought alive into the mess had been the means of introducing the cholera microbe into the mess." A subsequent inquiry, made about the 14th of August, led to the adoption of the theory that the dish-cloths used by the cooks had become infected with the cholera microbe whilst drying on the banks of a cholera-infected stream, and had, in turn, infected the food in the cook-house. An account of the outbreak and of the bacteriological inquiry will be found at pp. 140–143 of the Annual Report of the Sanitary Commissioner with the Government of India for 1896. The report concludes :— "However much we may admire the ingenuity of this hypothesis, it must be admitted that there are "few facts in its support." It will be observed that the inquiry regarding the causation of the disease is based on the assumption that the cholera microbe is the cause of cholera. To quote again from the Report of the Sanitary Commissioner with the Government of India :—"The statement that "cholera is caused by a particular vibrio must remain an assumption until the circumstances under "which that vibrio is potent to cause cholera has been discovered."

11. *Small-pox*, like other diseases, was unusually prevalent during the year. The deaths caused by it numbered 7,747, as compared with the mean for the previous quinquennial period of 2,298. The increase of mortality affected every district of the Provinces without exception ; but the districts which suffered most were not, as in the case of cholera, chiefly those in which privation was most severe. As usual, the disease prevailed with greatest virulence during the hot weather, and began to decrease in severity after the setting-in of the monsoon. By far the larger proportion of deaths occurred amongst infants under one year of age and children between one and 12 ; only 2,268 occurred amongst the population of ages exceeding 12 years. The decrease in the number of persons vaccinated during 1895–96 continued through the vaccination year 1896–97. The same causes to which the decrease was due in the former year were in operation during the latter. Whilst, under the adverse influence of distress arising from crop failure, the birth-rate fell from its normal of upwards of 40 per thousand of population to 31·72, the death-rate amongst children under one year of age rose to 318 against a normal of 260. In addition, vaccinators were in several districts withdrawn from their proper duties for work in connection with famine. Under these circumstances, it is no matter for surprise to find vaccination operations, which numbered 371,438 in 1895–96, decreasing to 327,457 in the year under report. The percentage of successful cases was about the same in both years. Of the children born during the vaccination year, 26,826 are calculated to have remained unvaccinated, as compared with 21,328 in the preceding year. Of revaccinations there was a large decrease, "which may be in part due to the orders issued on the subject. Vaccinators are frequently "tempted to perform revaccination more frequently than necessary with a view to supplement their "record when the number of primary operations falls short of the average. This practice has been "discouraged of late years." The Sanitary Commissioner states that arm-to-arm vaccination is now practised in very few places, animal being substituted for human lymph. The cost of supplying calf lymph during the year was only Rs. 211. 0. 9.

12. *Fevers* were excessively prevalent : the ratio of deaths from them rose to 29·55, as compared with a decennial average of 20·98. The disease was of the ordinary malarial type, and is said to have impartially attacked all classes, the well-to-do alike with those reduced by privation. The months during which it was most fatal would seem to confirm the belief in its malarial origin : it prevailed with greatest severity during the last five months of the year. At the same time its effects were most fatal in Damoh and Saugor, two of the districts which suffered most from scarcity during a series of seasons leading up to 1896, when it culminated in calamitous famine ; whilst its effects were least severe by far in Sambalpur, a district which did not in 1896, nor previously, suffer from scarcity. It is said that the Nimar district was likewise exempt from famine ; and its high fever death-rate of 46·26 is attributed in part to the influx of starved wanderers from other districts and provinces. The Sanitary Commissioner states with regard to Nimar that "the abrupt cessation of the monsoon at the "end of August proved disastrous to the crops," and adds, "there was little evidence of want or "scarcity among the people of the district generally, but the existence of famine and high prices "elsewhere caused a large influx of starved wanderers from other districts and provinces, and "accentuated distress among the artisan and weaving classes."

13. As might have been expected, *bowel-complaints* were unusually prevalent and fatal. The ratio of deaths caused by them increased from a decennial mean of 2·21 to 3·14. Their incidence was heaviest in the nothern districts ; in Jabalpur they caused a ratio of 9·79 deaths per thousand, in Damoh of 9·36, and in Mandla of 7·68. Their excessive prevalence in these districts was doubtless connected with the condition of distress from which the people of these districts were suffering. They belong to the class of so-called famine diseases, and, seeing that they are generally due to unsuitable or unwholesome food, their prevalence may be taken to imply a deficiency of suitable or wholesome food. There is no doubt that in jungle and hilly tracts the people are driven to subsist to a large extent during times of scarcity on jungle roots and fruits ; and that as a consequence of this dietary they suffer from and succumb to affections of the bowels.

14. The high death-rates recorded in some towns, such as Damoh, Jabalpur, and Murwara, were due, writes the Chief Commissioner, "to the existence in these towns of poor-houses where destitute "strangers were taken in, or the distribution of alms by private charity, which brought a large "number of beggars to centres where it was carried on."

15. *Sanitary Works.*—The most important of these were schemes for supplying water to certain municipalities. The Khandwa water-works were so nearly completed by the end of the year that it was possible to open them early in 1897. Progress, it is stated, is also being made with the works at Wardha, and a final estimate has been prepared for Bhandara. But during a year when the pressure of scarcity diverted the energies of the Public Works Establishments to famine relief, the prosecution of schemes of sanitary improvement had to remain more or less in abeyance for want of the establishment required to superintend their execution, and of the funds needful to carry them out. As the Chief Commissioner says :—"The scarcity and the subsequent famine greatly interfered with

"the active prosecution of sanitary reform which must wait for the setting-in of better times." The preparation of sanitary maps of districts continued in progress. The maps of two districts were received during the year, making a total of 12 now ready, and leaving only six more to complete the full number for the province. The Village Inspection Note Books prescribed by the Government of India have been introduced into selected villages in each district; but "owing to the unusual press of work in connection with famine and plague, Civil Surgeons devoted little time to village inspection." An examination of the list given on pages 52–53 of the report shows that the Civil Surgeons of the large stations of Jabalpur and Nagpur made no inspection of villages during the year; and that in the district of Hoshungabad only one village was inspected.

16. Briefly summed up: the year 1896 proved to be the worst of a series of seasons of bad harvests. The rains which for a time gave promise of being satisfactory, suddenly ceased about the end of August. Their cessation was followed by excessive heat and drought, which speedily withered up the crops and left the country in the grip of famine. The birth-rate was the lowest and the death-rate the highest ever recorded in the Central Provinces. The hard times and privation of the preceding years reduced the vitality of the people, lessening their fecundity, and rendering them more susceptible to the destructive effects of the diseases which usually accompany famine. As compared with the preceding year, the number of births decreased by 16,005, whilst the number of deaths increased by no fewer than 119,332. Cholera prevailed in every district, and carried off 52,982 people. Fevers and bowel complaints were unusually fatal. The sum of sanitary improvement in such a year could not fail to be small. The energies of the staff of every Department were fully occupied in relieving distress; whilst all available funds were required for providing the means for affording such relief. The year, in short, was from a health point of view, as probably from every other, the most calamitous which has hitherto befallen the Central Provinces.

12th October 1898.

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1896.

If an estimate of the state of the public health were deduced from the provincial vital statistics alone, it might be concluded that the year 1896 was the most unhealthy on record. In no previous year were so many deaths registered. The death-rate rose to a ratio of 36·33 per thousand of population and was in excess of the birth-rate by 2·64. We do not gather from the report that the meteorological conditions, or the high prices of food-grains were sufficient of themselves to account for this unusually high ratio of mortality. The information regarding the weather and prices is somewhat meagre and does not refer to the province as a whole, but is limited to three of the nine districts. In all of these three districts the rainfall was below, and in the case of one of them much below, the average; whilst in two of them the mean temperature was above, and in the third slightly below, the average. In two of the three prices were slightly, and in the third greatly, above normal. This dearness of food would doubtless unfavourably affect the public health by lowering the vital stamina, and consequently the resistance of the population to disease. But the strenuous endeavour of the Administration to improve registration was probably the chief cause which contributed to raise the death-rate. The effect of such improvement would be to lessen the number of deaths omitted from the registers, and so to bring about an apparent rather than an actual increase in the year's ratio of mortality.

2. If the registration of *births* is carried out with the same degree of accuracy as the registration of deaths, the population of Assam, instead of increasing, shows a tendency rather to decrease. Whilst the birth-rate for 1896 was only 33·69, and for the preceding year 31·00, the corresponding death-rates for the two years were respectively 36·33 and 33·72. For the five-year period preceding 1896 the ratios of births and deaths almost balanced each other, the birth ratio having been 30·38 and the death ratio 30·17. It is probable, however, that in Assam, as in other provinces of India, the number of births which are omitted from the registers exceeds the number of deaths omitted.

3. The Sanitary Commissioner compares, as he did last year, the death-rate recorded in Assam with the death-rates recorded in other Indian Provinces. From this comparison it appears that the Assam rate is only exceeded by the rate for the Central Provinces. In these latter, under pressure of scarcity, the people suffered greatly and the mortality was excessive. The two chief agencies employed in Assam for recording births and deaths were, as hitherto, the village watchmen, who are paid, and the village headmen, who are unpaid. The former are employed in the Surma, and the latter in the Brahmaputra Valley. Their comparative efficiency as registrars may to some extent be judged of by the ratios of birth and deaths recorded for the districts in these two valleys. Where, as in the Surma Valley, vital statistics are collected by paid watchmen, the ratio of births is 37·32 and of deaths 35·43; whilst in the Brahmaputra Valley the corresponding ratios calculated on the numbers of births and deaths recorded by unpaid village headmen are 30·13 and 37·39. The Sanitary Commissioner says:—"The monthly returns of vital statistics were carefully scrutinised in this Office, "and, when the numbers for any registration circle were obviously inaccurate, the notice of Deputy "Commissioners was called to the matter, with the request that they would cause inquiries to be "made with a view to include in the registers any vital occurrences which; by oversight, had not "been entered in the registers." Such a procedure, if generally followed by Sanitary Commissioners,

would render the publication of the full details given in Forms I. and II. appended to the Annual Report superfluous. The abridgment of these two forms, now sanctioned by the Government of India, could then be carried into effect without any fear of detracting from their usefulness, and with the result of greatly lessening the time and labour required for their preparation and publication.

4. Although progress in promoting accuracy of registration is being made, much remains to be done before the ratios of births and deaths can come to closely approximate the estimated ratios of 48 births and 42 deaths per thousand of the population. Dr. Stephen has given, in paragraphs 7 and 8 of his report, tables which record the number of married women between the ages of 15 and 39 in the *sadr* and sub-divisional towns of Assam, and the probable number of births calculated at the rate of 320 births of children per thousand of these women. The number of children born according to this calculation would give, in *sadr* towns, a birth-rate, per thousand of population, of 43·40; whilst the number actually registered gives a birth-rate of only 26·07. In sub-divisional towns the birth-rate similarly calculated would be 40·11, as compared with 30·40 calculated on the number of births actually registered. This test effectually disposes of the explanation so frequently offered to account for the low birth-rates recorded in towns—the preponderance in the number of males over the number of females in the population. Another point illustrated by the vital statistics of Assam, is the tendency which the number of males born has to approximate to the number of females born in proportion to the accuracy of the registration. Where registration is more carefully carried out by the paid village watchmen in the Surma Valley, there are, on the average, 106 male to every 100 female births recorded; where registration is less carefully carried out by unpaid village headmen in the Brahmaputra Valley, the average is 108 male to every 100 female births. Punishments are freely inflicted on watchmen and headmen who fail to report births and deaths. In a single district 519 of the former were punished, and in another district 120 of the latter. The details given by the Sanitary Commissioner in the 19th paragraph of his report show that the testing of the registers of vital statistics by Inspectors of Vaccination was, on the whole, carried out in a perfunctory manner. Civil Surgeons might be held responsible for seeing that the Vaccination Staff do not neglect this important part of their duties.

5. *Chief Diseases.*—Under the head of *cholera* 17,042 deaths were recorded, a number considerably less than that recorded for the previous year, and 2,193 less than the average of the five years 1890–94. In most provinces of India the months of least cholera mortality are the coldest, the first and last months of the year. In the districts of the Surma Valley of Assam, November, December, and January were the months of greatest, and June, July, and August the months of least, cholera mortality. In the districts of the Brahmaputra Valley there were two periods of maximum prevalence, and the same was the case in 1895 and in the three-year period 1892–94. The former of these periods included the months of April, May, and June; and the latter, November and December. The periods of minimum prevalence were also two: the first in January and February, and the second in August and September. The obscure nature of the conditions which determine the degree of severity with which cholera may prevail in two different localities is well shown in the report. "In 1895 cholera was most prevalent in the Kamrup, and least prevalent " in the Nowgong District. In the year under review, the disease was most prevalent in the Nowgong " and least prevalent in the Kamrup District." Tables 16 and 17 of the report would seem to suggest some connection between cholera prevalence and rainfall. The months of least rainfall, judging from the figures in the table, seem to be those of highest cholera mortality, and *vice versâ*. It might have been useful had the mean temperature of each month been shown along with the rainfall and ratio of cholera mortality of that month. It is probable that temperature decreased with rainfall and increased with the absence of rainfall. " These climatic conditions," writes Dr. Stephen, " are, however, merely " predisposing causes, and whatever the exciting cause of the disease may be, experience has shown " that it may be rendered inoperative by removing sanitary defects." It is a relief to find some one with the courage to set aside theories and assumptions regarding the causation of cholera, and who confines his remarks to what is known and practicable. He adds :—" Of the insanitary conditions " likely to produce cholera, impure water-supply is the principal, and cholera will be prevalent in this " province as long as the water-supply is liable to contamination by human impurities." To secure a water-supply which shall not be " liable to contamination," and to convert the people from their preference for water from tanks and rivers which are, and probably ever will be, " liable to " contamination," and which they have been accustomed to use from time immemorial, is a task which may exceed the power of the State to accomplish; but there is hope that the people themselves may come to appreciate the advantages of a pure water-supply, and so to give up using water from sources obviously liable to pollution. Yet, even when a pure water-supply has been provided, security against cholera will not necessarily be complete. " The water-supply in tea gardens is, for the most part, very " well protected, whereas in villages it is liable to all kinds of pollution." Notwithstanding this, the cholera death-rate among tea-garden coolies was 4·64 per 1,000, and that among the general population, excluding tea-garden coolies, only 3·30 per 1,000. The excessive mortality from cholera among tea-garden coolies has long engaged the attention of the Administration; and an experienced medical officer was deputed to inquire into its causes and to suggest remedies. This officer, after the completion of his inquiries, brought to notice many defects observed by him at the central coolie depôts, and during the journey by train and steamer, and made valuable practical recommendations with the view of remedying these defects; but the Sanitary Commissioner thinks that, so long as the coolies travel under existing conditions, cholera is liable to occur among them during the time they are on board the river steamers " however carefully the regulations may be carried out." He is, therefore, induced again to recommend " that arrangements be made for having all tea-garden coolies protected by " M. Haffkine's anti-cholera inoculation, before they are put on board the river steamers." Whether this recommendation, if carried into effect, would be successful in protecting the coolies from cholera during their transit to the tea gardens is a question which experience alone can decide.

6. *Small-pox and Vaccination.*—The deaths from small-pox numbered 5,444, and exceeded the number of deaths from this disease in the preceding year and the average number in the five-year period 1890–94. The ratio of deaths per 1,000 of population was 1·09; but in some districts was

much greater, reaching in Lakhimpur 4·16. The disease is shown to have been imported into parts of the province from Calcutta; but such importation would not have lighted up epidemics had the people amongst whom it was introduced been effectually protected by vaccination. Judging from the returns of vaccination for 1896-97, the protection of the population of the province against small-pox might be supposed to be great. No less a ratio than 45·71 per thousand of the population is stated to have been successfully vaccinated during the year. This ratio largely exceeds the birth-rate; but if the number of successful primary vaccinations of children under one year of age is compared with the number of births registered in 1896, it will be seen that there were only 45,865 of the former to 169,172 of the latter. Deducting from the latter figures the 36,353 deaths of children under one year of age, there would remain available for vaccination 132,819. Deducting again from this last number the number successfully vaccinated, there would remain 86,944 unprotected children. It will be evident, therefore, that vaccination, although making good progress in Assam, cannot yet be expected to control small-pox epidemics. To quote the Sanitary Commissioner's remarks :—" From the diagram " it appears that the death-rate from small-pox was highest in the Lakhimpur District, in which the " largest proportion of the inhabitants was successfully vaccinated during the last seven years, and " that the small-pox death-rate was also comparatively very high in the Sibsagar District, in which " the next highest proportion of inhabitants was protected." It is an unfavourable feature of the returns that there was some falling-off in the number of infants vaccinated. The number vaccinated in 1896–97 was 45,865, as compared with 47,176 in 1895. The percentage of successful operations recorded in Assam has attracted the notice of his Excellency in Council, who views some of the figures with grave doubt. To be asked to believe that of the 12,970 vaccine operations performed in a single district every one was successful, is a severe strain upon the credulity of anyone who has seen much of vaccination in India. It is suggested by the Government of India that the Sanitary Commissioner should himself verify a considerable number of the cases in the district of Nowgang. Calf vaccine lymph has largely superseded the use of humanised lymph, although arm-to-arm vaccination was still practised in two districts. The mortality among the calves bought for the supply of lymph seems to have been excessive. Of the 435 calves vaccinated during the year, " 20 died " before the vesicles were developed and 75 after lymph had been taken from them." In a country in which the cow is venerated, the deaths of so many calves in connection with the supply of vaccine lymph might possibly have the effect of increasing the caste prejudices of the vaccinators, already said to be strong, and thereby of making it difficult to procure a number of calves sufficient for the supply of vaccine lymph for the province.

7. *Fevers* are credited with having caused 101,347 deaths, or a ratio of 20·18 per mille of population. This ratio is considerably higher than that recorded for the preceding year, and very much higher than the average ratio for the five-year period 1890–94. This latter was only 16·18 per thousand of population. The steady improvement shown to be taking place in registration, rather than increase of mortality from fevers, is probably the main cause of this increase in the death-rate attributed to fevers. In the total number of deaths recorded as due to fevers are included deaths from malarial fevers, from kala-azar, and all other diseases in which rise of temperature is a prominent symptom. The differentiation of deaths due to kala-azar from those due to other fevers is probably difficult, and in some cases impossible. The number of deaths assigned to kala-azar in the returns is 15,894, and practically all of these were recorded in three of the nine districts of the province. The conclusion arrived at by Dr. Rogers, who was deputed to make inquiries regarding the origin and causation of this disease, differs from that which Dr. Giles had previously come to. Dr. Rogers is of opinion that kala-azar is an intense form of malarial fever, and that it is communicable. In our remarks on this disease in our Memorandum for 1895, we briefly stated the reasons which seemed to be opposed to the acceptance of the views held by Dr. Giles that kala-azar was due to the presence in the intestines of the parasite *Anchylostomum duodenale*. During the year increased facilities were provided for the purchase of quinine. Hitherto the people have perhaps not availed themselves of the facilities promised for them to the degree which was anticipated; but the most the State can be expected to do is to teach them the use of the drug, and to place it within their reach for purchase.

8. *Sanitary Works.*—In consequence of the want of funds, " very few important sanitary works " were put in hand or carried out during the year." Shillong and Gauhati are the only towns in which water-supply works have been constructed, and, comparing their death-rates before and after the introduction of these water-supply works, it appears that whilst the death-rates recorded during the five-year period preceding the opening of the works were 28·55 for Gauhati and 14·14 for Shillong, these rates had risen in the year under report to 36·48 and 14·32 in these towns respectively. These figures need not, however, be taken seriously. The increase is more likely to be the result of improved registration than of greater mortality. No very marked progress in the execution of important sanitary works need be looked for whilst the combined incomes of all the " municipalities, " stations, unions, and towns in the province " does not much exceed two and a half lakhs of rupees per annum; but the Sanitary Commissioner shows that " considerable attention continues to be " given to drainage, water-supply, and conservancy arrangements; and that nearly 50 per cent. of " the limited funds available were spent on ' sanitation proper.' "

9. Briefly, the year does not seem to have been an unusually unhealthy one, notwithstanding that the death-rate was the highest hitherto recorded. The improvement in the registration of vital statistics is probably the chief, if not the only, cause of the increase in the recorded number of deaths. Fewer births than deaths were registered, a result no doubt in part due to the well-known fact that fewer deaths than births escape registration. The number of deaths attributed to cholera was less than the number due to it in the preceding year, as well as less than the average in the previous five-year period. Small-pox, on the other hand, was more fatal than in the preceding years. Vaccination makes progress; but an unfavourable feature of the season's returns is the decrease in the number of infants vaccinated. The number of children under one year of age remaining unprotected against small-pox is great, and constitutes a constant source of danger when small-pox infection finds entrance into the province. Animal vaccine lymph is being substituted for humanized lymph throughout the province. We have noticed the excessive mortality amongst

the calves purchased for the supply of vaccine lymph—apprehending that this may possibly have an unfavourable influence in strengthening the prejudices already existing against calf-to-arm vaccination. Fevers are credited with having caused a considerably higher mortality during the past than during the previous year. Part, if not all, of this increase may be attributed to better registration. Few important sanitary works have been undertaken; but considerable attention was given to the water-supply, drainage, and conservancy of towns. Progress is necessarily restricted, owing to the limited amount of funds available.

12th October, 1898.

No. 8.

Memorandum by the Army Sanitary Commission on the Rajputana Sanitary, Vaccination, Dispensary, and Jail Report for 1896.

In the comparatively small portion of Rajputana known as Ajmere-Merwara, with its population of only somewhat over half a million, the rainfall was much above the average. In the rest of Rajputana, with its population of between 11 and 12 millions, the rainfall was either deficient or unseasonable for the crops. The early cessation of the rains was followed by extensive withering of crops and fodder as well as by scarcity of water. Prices were high in Ajmere-Merwara and still higher in many of the Native States. Distress resulted, and led to migration from some of the Native States of people with their cattle in quest of water and fodder. As in other parts of India in which the weather conditions of the year were more or less similar, this early cessation of the rains and the abnormal dryness of the subsequent months, although they resulted in scarcity of food and water, brought compensating benefits in lessened sickness and mortality from diseases due to malaria.

2. *Vital Statistics.*—The only returns which can be relied upon are those relating to the half million, or so, of people inhabiting the Ajmere Division. It is true that an attempt has been made to register births and deaths in 17 of the 21 Native States of Rajputana; but when we find one of these States recording a birth-rate per thousand of population of only 2·17 and a death-rate of only 3·17, it is evident that a good deal remains to be done before registration reaches the point when useful conclusions regarding the health conditions of the people can be drawn from the records of births and deaths. In the small population of Ajmere-Merwara for which reliable returns are available, the birth-rate fell from 35·29 in the preceding year to 32·77 in 1896. The Agent to the Governor-General, in his review of the Administrative Medical Officer's report, says:—"No satisfactory reason "has been given for the decrease in the birth-rate, and it points to defective registration." In our memorandum on the report of the previous year we wrote:—"The serious consequences of drought "have since become more fully manifest; and the more remote effects on fecundity and mortality "will doubtless be apparent in the statistics of the next and following years." As we had anticipated, there was in the year 1896 a decrease in the birth-rate, following, and due to, the poor crops and high prices of the preceding year. Registration was also unquestionably defective, but there is no evidence of its having been more defective than usual. Whilst the birth-rate decreased, the death-rate increased from 26·95 to 28·25 per thousand of population. It has already been stated that the mortality from fevers, bowel-complaints, and cholera showed a decrease; but this was more than counterbalanced by increased mortality from small-pox. The deaths among children under five years of age were excessive, accounting for no less than 55 per cent. of the total mortality of the year. As in other provinces of India, "the death-rates are generally more accurate than the birth-rates, "as it is less difficult to get deaths reported; the births of female children are specially suppressed, as "girls are still looked upon as a great discredit to parents and the household in general."

3. *Chief Diseases.*—Of *Cholera* there were only four sporadic cases in Ajmere-Merwara; but in several of the Native States the disease prevailed in epidemic form, 6,787 cases and 3,798 deaths having been reported. Much reliance cannot, however, be placed on these figures. By far the most severe outbreak occurred in Marwar, into which the disease is supposed to have been introduced by coolies from Bikanir. At Nawa, where 3,000 coolies were at work on the new salt pans in the Sambhar lake, there was a severe outbreak which was followed by the flight and dispersion of the coolies to their villages. But for the flight of the coolies "the mortality must have been much "greater, notwithstanding the disinfection of the wells by permanganate of potash and other sanitary "measures carried out to mitigate the virulence of the epidemic." The coolies of their own initiative adopted the most effectual method yet discovered of cutting short a cholera outbreak. In their flight, it is said, they disseminated the disease widely over Marwar.

4. The ratio of deaths due to *Fever* in Ajmere-Merwara was 17·34 per mille of population, as compared with 20·89, the mean of the previous five years. Contrary to the ordinary course of the disease, the highest mortality from it was recorded during the first, and not during the last quarter of the year, a result which may be attributed to the early cessation of the rains and abnormal dryness of the subsequent months. The sale of quinine at post offices was continued, and 36,618 doses were sold, as compared with only 34,782 during 1895. The increase in the sales would probably have been greater but for the diminished prevalence of malarial fever during the year. The continuance of the scheme for a further period has been sanctioned.

5. A severe epidemic of *Small-pox* accounted for 3,821 deaths in the Ajmere Division, equal to a ratio of 7·03 per thousand of population, as compared with a ratio of only 1·28 for the previous five years. If the best measure of the efficiency of vaccination is the degree of protection it affords

against small-pox, a high estimate cannot, judging from these figures, be placed on its efficiency in Ajmere-Merwara. The primary vaccinations increased from 15,583 in 1895–96 to 15,962 in 1896–97; whilst the percentage of successful cases increased from 96·24 to 96·82. Of children under one year of age, 11,128 were successfully vaccinated. The number of children born in 1896 having been 17,773, and the number who died under one year of age having been 4,624, there would remain available for vaccination 13,149. Consequently, the unvaccinated residuum would number 2,021. As usual, young children were the chief sufferers from small-pox. Of the total number of 3,821 deaths from this disease, 1,244 were those of infants under one year of age; whilst 2,458 were deaths of children under 12. In some places the mortality from small-pox was very high. In Goella, out of a population of 6,633, there were 297 deaths from this disease, giving a ratio of 44·78 per *mille* of population. In the Native States, with their population of between 11 and 12 millions, 4,021 deaths from small-pox were recorded. This probably is only equivalent to saying that registration in them is unreliable. In these States the numbers successfully vaccinated fell from 294,628 in 1895–96 to 269,300 in 1896–97. The success claimed in some States is phenomenal: in no fewer than 10 of the 21 the recorded percentage of successful cases in primary vaccination is 99 and upwards. Possibly, as in Bengal, some of the vaccinators are in the habit of omitting from their registers unsuccessful cases. However this may be, it is hard to believe that in a large proportion of these Native States nearly cent. per cent. of the operations prove successful.

6. Sixteen deaths from plague, or suspected plague, were reported in Rajputana. All of these were imported cases, and were mostly passengers taken out of trains. An interesting account is given in the report of the outbreak of plague which took place in 1836 and 1837 in Marwar Pali. Although in 1896 the disease was imported by persons coming from infected localities, it did not spread to the people of Rajputana. What share the measures of quarantine, segregation, and disinfection had in preventing the spread of the disease may be a matter of opinion. The Administrative Medical Officer writes:—"The season was greatly against the spread of plague in "Rajputana; the monsoon rains were over early, the winter rains were unusually light, and the "country was in consequence exceedingly dry; the hot weather also began earlier, and the heat was "more intense than usual, so all these conditions were unfavourable for the multiplication of the "plague germ, and the spread of plague among the people."

7. *Sanitation.*—The remarks under this heading show that, as regards one of the first essentials of healthy life, the inhabitants of most of the larger towns in Rajputana are not badly off: the water-supply of the majority of them is described as being "abundant and good." There are, however, exceptions. The water-supply of the city of Bhurtpore, with a population of 68,033, is bad; but it is proposed to give an improved supply to the city and suburbs as soon as funds become available. Dr. Adams says:—"Undoubted and steady progress is being made in sanitation in "Rajputana, especially in some of the capitals and large towns, in many of which it is now "beginning to be pretty generally recognized that an observance of the laws of health materially "benefits the community at large." He adds that village sanitation, although still very backward, is year by year receiving more attention; and urges on the Residency and Agency Surgeons the necessity for their taking an active personal share in the endeavour to introduce sanitary reform, instead of leaving this important duty to their subordinates, "if they intend village sanitation to "become anything more than a mere heading for their annual reports."

8. Under the heading "Dispensaries" an account is given of the progress being made in building new hospitals and dispensaries, and in improving old ones. The Administrative Medical Officer considers that "progress in this direction is very satisfactory."

9. The health of the only *jail* of the Ajmere Division was satisfactory. The death-rate, which was 45·35 in 1895 fell to 13·26 per mille in the year under report; whilst the admissions into hospital fell from 285 to only 69. In the jails of the Native States the mortality was much the same in both years, having been 28·17 in 1896 as compared with 28·09 during the preceding year. The admissions into hospital from malarial fevers and spleen diseases in the Ajmere jail fell from 74 per cent. of all the admissions in the preceding year to 19 per cent.; and in the Native States jails from 33 to 21 per cent. These favourable results were doubtless in great part due to the exceptional dryness of the year. It is suggestive of the hygienic conditions prevailing in the Ajmere as compared with the Native States jails that, whilst in the former 9 per cent. of the admissions and no deaths were due to dysentery, in the latter 14 per cent. of the admissions and 33 per cent. of all the deaths were due to that disease. Prevalence of dysentery in a jail may generally be taken as an indication that the hygienic conditions of that jail are unsatisfactory. Although in several of the Native States much is being done by improving the ventilation of the buildings, increasing the scale of diet, and other measures to ameliorate the condition of the prisoners, an examination of the brief accounts given of the jails shows that the state of many of them is such as to be a reproach to those responsible for its continuance, and a cruel injustice to those confined in them. The worst of these, the Banswara jail, may be taken as an example. We drew attention to the state of this jail in our memorandum for 1894, yet we have the following description of it in 1896:—"This jail is always unhealthy, badly "managed, and overcrowded; its site is bad, and also its construction, as I pointed out when it was "being added to some years ago. The death-rate rose from 62·07 in 1895 to the enormous mortality "of 131·60 in the year under report; but the admissions fell from 3,145·04 to 2,747·16 per mille." The condition of some of the other jails is little better. Of that of Partabgarh the Administrative Medical Officer writes:—"This jail is mostly very much overcrowded; it is badly drained, and "unsuited for a prison;" and of that of Shahpura:—"This jail has been very unhealthy throughout "the year, and it is generally much overcrowded. The mortality has gone up from 47·25 to 67·23, "and the admissions have risen from 2,244·8 to 2,386·55 per mille." It must be evident from these descriptions that, although "great progress has, during recent years, been made in jail management "in the Native States of Rajputana, and many of the jails are now in good order," the need for reform in others is urgent.

10. Briefly, the year 1896 was characterised by scanty or unseasonable rainfall, resulting in scarcity of water, deficient harvests, and high prices. Owing to the early cessation of the rains in the end of August or beginning of September, the last months of the year were exceptionally dry, and, as a consequence, unusually free from diseases of malarial origin. Registration is still very backward in the Native States, and the returns of births and deaths unreliable. In Ajmere-Merwara, in which registration is comparatively accurate, the birth-rate decreased whilst the death-rate increased, the former result being probably due to the hard times which prevailed during the preceding year, and the latter to the privations caused by crop failure and high prices in 1896. Cholera prevailed in severe epidemic form in some of the Native States, especially in Marwar; and small-pox was accountable for a ratio of 7·03 deaths in the Ajmere Division. The ratio of success recorded in primary vaccination continues to be phenomenally high in a number of the Native States, suggesting the need for vigilance on the part of inspecting officers. Plague was imported into Rajputana, and 16 deaths from plague, or suspected plague, were reported. The disease did not, however, spread to the inhabitants of the country, but was confined to travellers from infected localities outside the province. Progress in sanitation is being made in the Native States, more especially in some of the capitals and large towns. Improvement of the jails of most of the Native States is also being effected, but in some, owing to the lamentably defective sanitary conditions still prevailing in them, the death-rate continues to be excessive.

12th October, 1898.

No. 9.

Memorandum by the Army Sanitary Commission on the Medical and Sanitary Report of Coorg for 1896.

1. Of this Report the Chief Commissioner truly observes that "the remarks are almost entirely "confined to a bald repetition of the contents of the statements." Little attempt is made to explain variations and anomalies in the statistics. As compared with other provinces Coorg is insignificant in its extent and population, the latter numbering only 173,055; but an examination of the causes which render its vital statistics exceptional would not on that account necessarily be devoid of interest or usefulness.

2. Coorg did not suffer from the deficient rainfall which brought disaster to most other provinces of India during the year: the 157·63 inches recorded exceed the average of the previous 13 years. There was no unusual scarcity of food supplies, and prices did not greatly differ from the average of the quinquennial period 1891–95. The influence of these conditions on the public health, as gathered from the statement given in paragraph 3 of the Report, does not appear to have been adverse. Except in December, when it is said to have been "indifferent," the public health during each of the other 11 months is described as having been "fair."

3. *Vital Statistics.*—In the previous year, and generally during the previous 10 years for which statistics are given, the number of deaths exceeded the number of births, but in 1896 there was a small excess of 32 births over deaths. The excess of deaths over births hitherto recorded has been regarded as due to the influx into Coorg of large numbers of coolies who come to work on the coffee estates, and who do not bring their wives with them. Doubtless this is one of the causes which has contributed to bring about the excess of deaths, but other peculiarities in the vital statistics of Coorg lead to the suspicion that defective registration may also be concerned in bringing about this result. According to Annual Form No. I., the proportion of the sexes born is 97·68 male to every 100 female children. If these figures represent the actual proportion, Coorg differs from the rest of India in having more female than male children born in it. In the report it is stated that of 160 deaths which occurred in Mercara town, 45 were coolies from Mysore, Malabar and other places, and were not inhabitants of Mercara. To ascertain the real mortality among residents, these 45 deaths, it is said, should be deducted, when the death-rate of the town would be found to be, not 22·75, but only 16·35 per thousand of population. Needless to say, a death-rate of only 16·35 would be an incredible one in Mercara. Again, although the returns show that only 97·68 male children were born to every 100 female children, the deaths of 123·01 males to every 100 females are recorded. The explanation of this excess of deaths of males is doubtless the same as that given to account for the disproportionately small number of births as compared with deaths, viz., the influx into Coorg of a large number of coolies without their wives. As the Chief Commissioner remarks, it is not easy to understand why the deaths should so largely exceed the births in the two largest towns, especially in Mercara, where sanitation is presumably attended to, and where there is a supply of good drinking water, or why during the past two years the number of births should have decreased so considerably. Defective registration will probably be found to be to some extent accountable for these anomalies and variations. The scattered nature of the dwellings of the people renders accurate registration unusually difficult; and it is gathered from the account given of the agencies entrusted with the record of births and deaths that their efficiency is more than doubtful.

4. *Chief Diseases.*—*Cholera* accounted for 49 deaths, giving a ratio per thousand of population of 0·28 as compared with a mean of only 0·09 for the previous five years. *Small-pox* deaths numbered 18. An examination of the record of small-pox mortality shows that the disease prevails in Coorg periodically in severe and fatal epidemic form. In 1892 the ratio of deaths from small-pox was 5·27, and judging from the large proportion of the infant population which annually escapes

vaccination, the recurrence of a similar epidemic is far from unlikely. During the year 1896, according to the returns, there were 4,606 children born: of these 1,061 died, leaving available for vaccination 3,545. Of this last number 1,289 were successfully vaccinated, leaving no fewer than 2,356 unprotected against small-pox. The recorded percentage of success in primary vaccination was 92·02, and in re-vaccination 82·95. It is hard to believe that so high a percentage of success was obtained in re-vaccination. In Coorg, animal lymph is exclusively used in vaccination.

5. As usual, *fever* was credited with the largest number of deaths. The ratio of deaths attributed to this cause was 20·53 per thousand of population as compared with 23·48 in 1895, and with a mean of 19·66 during the previous five years. The total death-rate for the province having been 26·43, if the ratio due to fever be deducted, only 5·90 remains to be credited to all other diseases. "It is "perhaps, unsafe to generalize from the figures of one year," writes the Chief Commissoner, "but "the diminution of fever, which is the main disease of Coorg, seems to show that this ailment has no "necessary connection either with an abundant rainfall, or with a rise in the price of *ragi*, which is "probably in some parts of Coorg the staple food of the country." With a view to alleviate the effects of fever, the sale at post offices of quinine powders in 5-grain packets was introduced in January in places where there were no dispensaries. It is added that, "an endeavour was made to "ascertain the number of packets sold at each post office, but without avail." The reply received from the Postmaster-General of Madras to a request for this information is worth placing on record. "It is one of the principles and conditions of the system under which post offices sell quinine, that "they do not keep or render any accounts of quinine sales or stocks." Under such conditions, which are probably peculiar to Madras, there may not unnaturally be some hesitation in entrusting quinine to post offices for sale.

6. *Sanitary Works.*—No permanent work of importance was executed during the year. An estimate was made for providing the town of Virajendrapet with a good water-supply; but the cost was found to be almost prohibitive. In paragraph 7 of our last year's memorandum we referred to the steps being taken to build shelters for the use of coolies entering and leaving the province. It is satisfactory to learn that the building of these is being energetically proceeded with, and that they were expected to be ready for occupation before the bursting of the monsoon of 1897. The mortality amongst these coolies has hitherto been excessive and has been suggested as the chief cause of the high death-rate of the province. Regarding the introduction into selected villages of a system of village sanitary inspection, in accordance with the instructions issued by the Government of India, "the information given in the reports is meagre," and the Chief Commissioner requests that the Civil Surgeon will bear the point in mind and deal with it more fully in future reports.

7. *Summary.*—The year was characterized by a rainfall above the average. There was little alteration from ordinary in the price of grain. The number of births was slightly in excess of the number of deaths: hitherto the latter have usually been the more numerous. There are peculiarities in the vital statistics recorded in this little province which need explanation. The records are exceptional in showing a death-rate generally in excess of the birth-rate, and the number of female to be in excess of the number of male children annually born. Fever, as usual, was accountable for the greater part of the mortality. Although more numerous than during the preceding year, the deaths from cholera and small-pox were not excessive. The returns of vaccination show serious neglect of infant vaccination. The erection on the principal *ghaut* roads of shelters for the coolies entering and leaving Coorg is being vigorously proceeded with. A scheme for providing the second of the two chief towns of the province with a good supply of drinking water has to stand over for the present owing to want of a sufficiency of funds. In next report an endeavour might be made to explain some of the more striking anomalies and variations noticed in the vital statistics of the province.

12th October, 1898.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1896.

For the sake of brevity the form of heading hitherto used in dealing with the Report of the Sanitary Commissioner of Madras has been adhered to; but the title of the volume containing the report has undergone considerable alteration: it is now "The First Annual Report of the Sanitary "Board, the Thirty-third Annual Report of the Sanitary Commissioner, and the Seventh Report of "the Sanitary Engineer, Madras, 1896." It is stated that towards the end of the year the Sanitary Board was reconstituted. It now consists of three members, the Chief Engineer, Public Works Department, the Surgeon-General with the Government of Madras, and a member of the Indian Civil Service. The Chief Engineer is President, and the chief assistant of his office Secretary of the Board. A copy of the rules for conducting the business of this Board is given. From these rules it appears that no sanitary work estimated to cost more than Rs. 200, shall be undertaken by any local board or municipal council without the prior approval of the Sanitary Board. The initiation of sanitary works of any importance will thus require the sanction of the Board. Rule 14 describes the procedure to be adopted in dealing with a major sanitary scheme. In the first place, the Sanitary Commissioner will bring to the notice of the Board the need for such a scheme: the Board will then call on the Sanitary Engineer to report how the scheme can best be carried out: the Engineer's report will be sent to the Sanitary Commissioner for his opinion from a sanitary point of view: should the latter condemn the Sanitary Engineer's scheme, the Board will decide whether the Sanitary Engineer should be required

to modify his proposals, or whether the matter should be at once referred for the orders of Government as to the preparation of detailed plans and estimates. With such a system of check there should be little danger of insufficiently considered schemes of sanitary improvement being hastily undertaken in Madras. The report of the Board for 1896 is commendably short. It is contained in less than three pages, and is followed by an appendix of other three pages giving a list of the schemes dealt with by, and a statement giving particulars of works referred to, the Sanitary Board for scrutiny.

2. The Sanitary Commissioner's Report, which is submitted to Government by the Sanitary Board, opens with a section on the year's rainfall. The Madras Presidency was no exception to the rest of India in the irregular and unseasonable nature of its rainfall during 1896. Although the northern districts of the east coast received their normal amount of rain during the south-west monsoon, in three out of four of them the north-east monsoon of the last three months of the year was a failure. Likewise in the Deccan districts, which lie within the so-called "famine zone," both monsoons were scanty, the north-east monsoon being practically a failure. The consequences of this insufficient and irregularly distributed rainfall were serious. Failure of crops and of fodder followed, causing much suffering to man and beast. The Sanitary Commissioner, however, shows that crop failure was not the sole cause of the distress; high prices, due to active export of grain to Bombay and the North-Western Provinces, in which famine prevailed, contributed largely to scarcity and privation in Madras.

3. *Vital Statistics.*—In spite of the efforts to improve it, registration of births and deaths is still very defective. During the year "a circular was issued to all municipalities directing their attention "to the importance, from a sanitary, economical, and medico-legal point of view, of insisting on "prompt registration." This exhortation, the Sanitary Commissioner believes, had a satisfactory influence. The statement given at page 23 of the report shows that, in the case of 543 births and 407 deaths which failed to be registered in municipalities, prosecutions followed. This is perhaps the most effectual form of exhortation where neglect of registration persists from year to year. The Governor of Madras, in reviewing the report, writes:—"The system of registration continued "the same as in the previous year, but in its Order No. 476 (Revenue), dated 21st September 1896, "the Government decided to take steps for its improvement:—

"(1.) By placing the village establishments in the zamindari tracts under adequate control;

"(2.) By initiating legislation with the object of making registration in more advanced areas "compulsory by law; and

"(3.) By gradually transferring the duty of conducting registration in rural areas from the "overworked village accountant to the village headman."

It is not clear how the first of these steps will operate in improving registration. With regard to the second, it seems late in the day to restrict the improvement of registration to limited areas. Of the influence which the last of the steps mentioned will exercise, it will probably only be possible to judge after the change has had effect for some time. Meanwhile, Madras records a birth-rate for 1896 of 29·9, and a death-rate of 20·6, per mille of population. It may serve as some indication of the state of registration in the Madras Presidency if we compare its birth and death ratios for 1896 with those recorded in the neighbouring Provinces of Bengal, Bombay, and the Central Provinces for the same year:—

	Births.	Deaths.
Bengal	38·03	34·17
Bombay	36·76	31·69
Central Provinces	31·68	49·31
Madras	29·9	20·6

In all of the Provinces mentioned scarcity and famine prevailed, so that the conditions influencing at least the death-rates in all of them were more or less similar. It is impossible to believe that in a year during which scarcity, deepening into famine, afflicted the Madras Presidency over a considerable part of its area, 20·6 can represent even approximately the ratio of deaths per thousand of its population. The comparison of its record of vital statistics with the record given by its neighbours—and the latter is doubtless far from perfect—will afford some measure of the incompleteness of registration still prevailing in Madras. It is in rural areas that registration is most defective. In the 57 municipalities the birth-rate for the year under report was 36·1, and the death-rate 30·7 per mille of population: in rural areas the recorded birth-rate for the same year was 26·7 and the recorded death-rate 18·4. The district of Malabar, with a population of 2,636,674, records a birth-rate of only 22·5 and a death-rate of 15·7. It would not perhaps be an exaggeration to estimate the actual number of births and deaths in this district at twice the number registered.

4. *Chief Diseases.*—Cholera prevailed in every district of the Presidency and caused a total of 47,847 deaths during the year, or more than twice the number ascribed to it in the preceding year. As usual, its severity varied greatly in different places and at different times. Whilst in South Canara only 13 persons died from it, in Coimbatore 10,731 deaths are recorded as due to it. So with regard to the season of the year when it was most prevalent, taking the Presidency as a whole, 17,999 deaths are recorded against it in December and only 272 in March. The Sanitary Commissioner gives

a table showing the incidence of the disease according to monsoon periods; but cholera refuses to accommodate its incidence to any law which has yet been discovered. If the district of Bellary is selected from Statement No. VII., Appendix D, it will be seen that its course during the year resembled that common in the more Northern Provinces of India. The three first months and the two last months of the year were those of least cholera mortality; whilst the greatest number of deaths took place in May, June, and July. On the other hand, not a single death was recorded in Coimbatore during the first six months of the year; whilst September and December were the months of greatest cholera mortality. The partial nature of its incidence is as characteristic in Madras as in other parts of India. Although it prevailed in every district of the Presidency, in only 4,390 villages of a total of 44,678 did cases occur, or in about one in every ten. A satisfactory explanation of the reason why the nine villages escaped and the one was attacked is still wanting. In point of their sanitary or insanitary condition there is probably little distinguishable difference between those that suffered and those that escaped. Such sanitary improvements as have been effected in towns have not, so far, placed them in a better position for warding off cholera than villages in which things remain pretty much what they have been from times immemorial. "The "mortality in municipalities from this disease was at the rate of 2·1 per mille of population," as compared with a rate of 1·3 for the Presidency as a whole. Unfortunately, the most effectual of all the hitherto discovered methods of dealing with a cholera epidemic cannot readily be applied to cities and towns. Prompt evacuation of the affected locality, when such prompt evacuation is practicable and properly carried out, has scarcely ever been known to fail in cutting short an outbreak of the disease. Year after year the efficiency of this method is demonstrated in the case of our troops and jail population. The same remedy applies to plague. In the case of neither disease has a remedy been found so successful as the prompt and thorough abandonment for a time of the affected locality. But prevention is better than cure; and perhaps there are few who doubt that in sanitation thoroughly carried out in every detail this prevention will ultimately be found.

5. *Small-pox* was accountable for 9,410 deaths. The returns show that no district enjoyed entire immunity from the disease. Of the total number of deaths, 2,245 occurred amongst infants under one year, and 3,632 amongst children between one and 12 years of age. In some towns, such as Vellore and Gudiyattam, the death-rate was very high, having been 5·3 in the former and 2·1 in the latter. It is evident from these figures that, as stated in the review of the report, compulsory vaccination is not being strictly enforced in these towns. During the year 1896–97 there was an increase of 49,549 cases of vaccination. Primary vaccine operations increased by 52,506; whilst re-vaccination operations decreased by 2,957. The ratio per cent. of total successful cases, according to the statement given in paragraph 9 of the Vaccination Report for 1896–97, is 92·5 in primary vaccination and 80·3 in re-vaccination, showing a slight falling-off as compared with the ratios for the preceding year. This, however, the Inspector of Vaccination thinks is not "to be deplored, as it "probably points to greater accuracy in the returns." Although the returns of vaccination in the Madras Presidency are now being subjected to special scrutiny with a view to preventing a continuance of their falsification, it is evident that the Inspector is not yet satisfied with their accuracy or with the sufficiency of the means at his disposal for the detection and prevention of fraud. He suggests the appointment of two Assistant Inspectors of the Assistant Surgeon class, "whose duty it would be to inspect the verification work of the deputies, and so impose a wholesome "restraint on the dishonest practices which at present prevail to too large an extent in the "department." He adds, that the expected improvement as regards the accuracy of the returns submitted would enable one in future to "get an idea of the actual extent to which the population is "really protected, which is impossible at present." Perhaps, if the Civil Surgeons were to have charge of, and were held responsible for, the work of vaccination in their districts, the improvement of the accuracy of the returns might be effected without the need for appointing extra inspectors. During the year, the number of children under one year of age vaccinated was equal to 33·6 per cent., or one-third of the total number of registered births. From these figures it is evident that, until a very large increase in this proportion comes to be effected, small-pox will not die out from want of susceptible material to keep it alive. In some of the districts the proportion of infants protected by vaccination is altogether insignificant. In the vast district of Malabar, with its population of upwards of two and a half millions, only 1·4 per cent. of the children under one year of age were successfully vaccinated. "Fresh calf vaccine shows, as usual, the greatest percentage of success, "viz., 97·2; then comes vaccine sent out in glass without any preservative; then lanaline paste; and "lastly glycerine with 94·6, 94, and 88·9 respectively." But until the department has been purified from the fraudulent practices which have hitherto prevailed and, according to the Inspector, still prevail in the preparation of its returns, too much weight need not be given to these or to any of the other figures supplied.

6. *Fevers* were less fatal than during the preceding year, but the ratio of deaths per mille of population recorded to have been due to them was slightly higher than the mean ratio for the previous five years. An examination of Table IX. in Appendix D. shows that, as Dr. King remarks, "the incidence of fever on the population varies but slightly, from year to year." The shortness of the rainfall, which resulted in crop failure and scarcity in the Deccan districts, was no doubt at the same time the cause of a sensible decrease in the prevalence of malarial fevers in three out of the four of those districts. Increased mortality, which almost invariably accompanies or follows privation due to scarcity, seems thus to have been to some extent compensated for by decreased mortality arising from the cause which brought about the scarcity. Regarding the increase of mortality from fever in the town of Karúr, the Sanitary Commissioner writes:—"In this case "the sub-soil of the town is saturated with soakage from cesspools, and as typhoid is a recognised "disease in this town, it need not be assumed that solely malarial fever was dealt with."

7. *Sanitary Works.*—Progress is being made in the direction of providing the larger towns with water-supplies. "Four water-supply works were in progress during the year. Of these, the "Trinchinopoly and Dindigul works were completed and handed over to the Municipal Councils "concerned, and fair progress was made in carrying out the schemes for the water-supply of Kurnool

" and Conjeeveram." In addition " nine surveys were completed and five water-supply schemes were " prepared and submitted to the Sanitary Board during the year, while the estimates for five other " water-supply schemes underwent revision." Excluding the city of Madras, which has a separate sanitary report for itself, the estimated income of the other municipalities of the Presidency for 1896–97 was just over thirty-three and a quarter lakhs of rupees ; and of this amount close upon half, or 48·1 per cent., was allotted for sanitary purposes. Of the sum so alloted, over four lakhs were expended on conservancy, nearly three lakhs on improvement of water-supply, and close on two lakhs in improving village sites. From this it will appear that the main want is the want of money for improving the sanitary state of the towns of Madras as of the other towns of India. The funds available for sanitary purposes in the Madras Municipalities are obviously out of all proportion insignificant in amount, when the requirements of the municipalities are taken into account. As Dr. King remarks :—" It cannot be said that the rate of sanitary progress in municipalities is such as " to render the sanitarian sanguine, still progress is apparent, and, this being so, it may be assumed " that reforms will be introduced in an ever-increasing ratio as one improvement is almost necessarily " followed by another with the object of securing full results."

8. A table is given at page 46 of the report, showing the effect of public water and sewerage works in the case of the nine towns already provided with water-supplies. In only three of these towns are drainage works completed. A comparison of the death-rates recorded before, with those recorded after, the completion of these works constrains the Sanitary Commissioner to admit that the results acquired so far are not striking. He adds :—" No other than a mediocre result from sanitary works " in this Presidency can, however, be expected, so long as they are not constructed so as to involve " not the major portion of towns, but the whole, so long as the facilities afforded are not such as to " permit free use of the water by the inhabitants in all parts of the town and at all times of the day ; " and, above all, so long as the municipal councils persist in retaining the old wells and tanks which " the public water-supplies should have replaced."

9. On sanitary works carried out by district boards, an account is given of the sums expended in the table on page 50. Tho total amount of the sanitary allotment for the 21 districts for the year 1896–97 was considerably under seven lakhs of rupees, showing again that want of funds, rather than want of wish to make improvements, retards progress.

10. Briefly told, the year was an unfortunate one for those who depend on the land for their livelihood, and these constitute the vast majority of the population of upwards of 35 millions. The rainfall was scanty as well as irregular in its distribution, and followed by extensive failure of crops, more especially in the Deccan districts and in the Northern Circars. This failure pressed hard on the people ; but if failure of crops and scarcity followed deficient rainfall and drought, so also did decrease of diseases due to malaria follow the same causes. Cholera prevailed in every district of the Presidency at some period during the year. Its history in 1896 cannot be said to have added much to our knowledge of its causation. The mortality from fever in Madras varies but little from year to year. Although small-pox was wide-spread, the number of deaths due to it was not excessive. Of new sanitary works, the most important were those in connection with water-supply. No definite conclusion can yet be come to regarding the influence which the execution of these works has exercised on the public health. In the first place, the water-supplies provided are not exclusively used by the inhabitants, many of the old wells and tanks being still resorted to ; and in the second place the registration of vital statistics is still so defective as to form an unsafe basis on which to rest deductions. The report is shorter than usual, but seems to omit nothing which it should include.

12th October, 1898.

No. 11.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1896.

In accordance with the orders of the Bombay Government, vital statistics of Europeans and Eurasians are given in this report separately from those of the Native population. The former classes in point of numbers constitute an altogether insignificant portion of the population of the Presidency. According to the census of 1891 the European civil population in the Bombay Presidency, exclusive of cantonments in quasi-foreign territory, numbers only 18,486 persons, and Eurasians only 8,519. From an examination of the statement showing their distribution, it appears that the bulk of them are concentrated in the towns of Bombay, Karachi, and Poona. The birth-rate amongst Europeans is stated to have been for the year only 15·95, and the death-rate 16·44 per thousand of population. But it would be necessary to know the relative proportion which the sexes bear to each other before assigning significance to these figures. The explanation of the low ratio of births probably lies in the disproportionately large number of males as compared with females. The low death-rate follows, partly at least, from the low birth-rate ; a high death-rate accompanying a high birth-rate, as a general rule, in all communities and in all countries. Amongst Eurasians the ratios of births and deaths—18·3 of the former and 22·89 of the latter—although still low, are considerably higher than those recorded for Europeans. But it would be unsafe to draw conclusions from the recorded vital statistics of a community numbering only a few thousands. One noticeable feature of the statistics given of both Europeans and Eurasians, is the predominance of the births of male as compared with births of female children. Amongst Europeans there were 161

male to 133 female children born; and amongst Eurasians 99 male to 57 female children. Of Europeans, 188 males to 115 females died. These numbers seem to confirm the estimate made of the probable constitution of the European population in the Presidency. Of Eurasians 195 died; and of these, 111 were males and 84 were females. To be of use for purposes of comparison with the statistics of the native population, the population numbers of Europeans and Eurasians would need to be greater than they are, and the exact constitution of the communities as regards sexes and persons living at different ages would have to be known. Without such data no comparison that would not probably be misleading can be made. The diseases from which Europeans and Eurasians chiefly died were, as in the case of the natives, cholera, small-pox, fevers, and bowel-complaints. Amongst Europeans the ratio of deaths from cholera was less than half the ratio amongst natives, having been 0·71 per mille as compared with 1·8. The ratio of deaths from small-pox, contrary to what might have been anticipated, was somewhat higher amongst Europeans than amongst natives, having been 0·54 per mille as compared with only 0·34. The same was the case with regard to deaths from diarrhœa and dysentery, the ratios being higher in the case of Europeans than in the case of natives, in the proportion of 2·33 of the former to 1·92 of the latter. But it is in point of mortality from fever that the difference between the two races is greatest: whilst the recorded ratio of deaths per thousand of population was 21·90 amongst natives it was only 2·66 amongst Europeans.

2. The year under report is described by the Sanitary Commissioner as having been an unhealthy one. Its most marked meteorological features were irregularly distributed and unseasonable rainfall, higher maximum temperature and higher range of temperature than in 1895. For the first four months of the year there was practically no rain. The monsoon set in regularly in the month of June. During July and August the fall was in parts of the country so excessive as to be destructive of the crops; early in September the monsoon ceased, and there was practically no rain in October. A more or less complete destruction of the *kharif* crop was thus brought about. Some rain fell in November and December, but too late, except in certain districts, to materially improve prospects. With the failure of crops, prices rose enormously. Leaving out fractions, wheat, which could be bought at from 18 to 12 seers per rupee in January, cost double in December. Rice rose to about six seers per rupee; and the greater and lesser millets, as in the case of wheat, rose to about double the price ruling in January. These high prices caused much distress amongst the poorer, and especially amongst the landless, classes. Scarcity deepened into famine, and in the nine districts which suffered most, upwards of seven and a half millions of the population were affected. By the beginning of November State aid had to be given for the relief of distress and the saving of life. It would be contrary to all experience if, in a season of such exceptional meteorological characteristics followed by such calamitous results to the crops and by so great a rise in the price of food, the public health did not suffer.

3. *Vital Statistics.*—It is true that, in spite of the unhealthiness of 1896, there was "a very "sensible increase in the population of the Presidency"; but this increase was of course determined by conditions mainly affecting, not 1896 but its predecessor. The births exceeded the deaths by no fewer than 95,375, and the mean number of the preceding 10 years by 50,021. The recorded birth-rate for the year was 36·76 per thousand of population, against 35·83 in 1895 and a mean of 36·39 for the previous 10 years. The birth-rate of the City of Bombay continues to be exceptionally low. Evidence was given in last year's memorandum that this was in great part due to defective registration. In the Sind Division the birth-rate was 26·27, as compared with 36·76 for the Presidency. The difference is believed to be largely due, as in the case of Bombay City, to neglect of registration. Tho preponderance of male over female births, 136·93 of the former to 100 of the latter in the Upper Sind Frontier, may be taken as a measure of the neglect to register the births of female children rather than as evidence of an abnormal excess of male children born. The recorded birth-rate in towns was was 29·61 against a rural birth-rate of 37·76. This would seem to show that in spite of the greater intelligence assumed to characterise the dwellers in towns, the record in them of vital statistics is more negligently carried out than in the country. The Sanitary Commissioner is still of opinion "that overcrowding on unhealthy areas and living in badly ventilated rooms are the "causes" of the high percentage of still-born children in the City of Bombay. This may have some effect in raising the percentage; but, as the Secretary to the Government of Bombay observes in his review of the report, "the Sanitary Commissioner has not been able to adduce any facts to refute the "suggestion that the abnormally high percentage in Bombay City is due more to the great inaccuracy "of the live birth-rate on which the percentage of still-births is taken, than to any other cause."

4. The recorded death-rate for the year was 31·69 per mille of population, against 28·61 in 1895, and a decennial mean of 28·74. No doubt deaths are everywhere more carefully registered than births, yet even in regard to deaths the ratios recorded for the five Collectorates of the Sind Registration District, varying as they do from a maximum of 24·89 in Karachi Collectorate to as low as 17·46 in Hyderabad, witness to very defective registration. Bombay City, however, cannot share in this criticism. If its birth-rate of 19·35 is incredibly low, such is not the case with its death-rate of 40·99. It is curious that towns like Bombay and Nasik, which record almost the lowest birth-rates, record death-rates much above the provincial average. The rate, as already stated, for Bombay City is 40·99 and for Nasik 54·90. The very circumstance of their death-rates being so high suggests that their birth-rates of 17·18 and 17·78 respectively, are understated. It is an acknowledged axiom that a high birth-rate generally, and in the absence of special conditions, implies a high death-rate, and *vice versâ*. This may be illustrated by reference to the table on page 19 of the report. The six towns which give the highest birth-rates also give death-rates above the provincial average. Omitting the first, which, with a birth-rate of 61·46 gives a death-rate of only 32·31, the other five, with birth-rates running between 48·26 and 56·26, have also death-rates varying from 38·92 to 51·19.

5. The death ratio of 179·38 for infants under one year of age in the Bombay Presidency is pretty high, but cannot be said to be excessive. The corresponding ratio for Madras was 124·7, and for the Central Provinces 318·14. In Madras, registration is admitted to be still very defective. The months of highest mortality were July and August: they were also the months

of greatest cholera prevalence. Although the last three months of the year were months of severe scarcity, their death-rates are the lowest of the twelve. This was no doubt due to the subsidence earlier in the season of cholera, and to lesser prevalence of malarial diseases consequent upon the premature cessation of the rains and the resulting unusual dryness of the last three months of the year. Besides, the Government, anticipating from the failure of the crops that privation would follow, promptly came to the relief of the distressed and preserved the lives of thousands who, but for this timely aid, would have succumbed. The recorded ratio of deaths among Hindus was 33·74 per mille; and among Mahomadans only 24·48. The comparatively low death-rate among Mahomadans "is attributed to the very defective registration in the rural areas of Sind, "where the system is in its infancy."

6. *History of Chief Diseases.*—Cholera was accountable for 35,404 deaths, or four times as many as during the preceding year. The three first and the three last months of the year were those of greatest immunity from the disease; whilst July was the month of, by far, its greatest prevalence. The Sanitary Commissioner gives a table showing the mortality from cholera by seasons. From this he finds that 23,501 deaths occurred in the rainy season of 122 days, and 8,850 in the hot and dry season of 61 days. Some of the Deputy Commissioners, in their remarks, would seem to imply their belief in some connection between rainfall and cholera prevalence. Regarding the outbreak in Khándeish we find:—"All the rural circles were "affected. It is stated to have been imported from the Hyderabad Assigned Districts. The "mean temperature was unusually high, the rainfall less, and the price of food grains was "about the average during the period of the outbreak. There was a heavy rainfall in July; "and by the end of September, the rains having ceased, the disease practically disappeared." At the commencement of the outbreak in this case, the conditions appear to have been unusually high temperature and unusually scanty rainfall; whilst the cessation of the disease was preceded by heavy rainfall with, it may be presumed, a consequent decrease of the temperature. In the Bijapur District cholera was excessively prevalent, causing 5,249 deaths. Dr. Clarkson "is of "opinion that the large number of step-wells is one of the causes of the recurrence year after "year in that district." In some circles of the Ahmednaggar, Poona, and Bijapur Collectorates the mortality was very great, rising to a ratio, per thousand of population, of 12·68 and 14·74. The cause of the escape of one village or town and the invasion of its neighbour, both being apparently alike as regards their sanitary condition, seems to be as far from discovery as ever. Out of 21,608 villages in the districts affected by cholera, 2,642, or 12·23 per cent., were attacked during the year.

7. *Small-pox* caused 6,443 deaths, or nearly three times as many as during the preceding year, and more than double the decennial mean. Of the total number of deaths, 1,901 occurred amongst infants under one year of age, and 3,336 amongst children over one year and under 12 years; so that only 1,206 remain to be accounted for amongst persons of upwards of 12 years of age. But although the death-rate was higher than usual, it only amounted to a ratio of 0·34 per mille of population. Notwithstanding that vaccination work must have been impeded owing to the prevalence of plague, and to the floods in Sind, the numbers vaccinated show no sensible decrease for the year. There was a slight increase in the number of primary vaccinations, and a slight decrease in the number of re-vaccinations, the total of both being only 81 below the total for the previous year. The percentage of success was practically the same in both years. In the City of Bombay animal lymph was exclusively used in vaccination. A question was raised regarding the likelihood of the transmission of plague by means of vaccine lymph. The Sanitary Commissioner thinks that, as regards calf-to-arm vaccination, at all events, there is no danger; and, as a matter of fact, there was no report of the communication of plague by animal vaccination. It was nevertheless considered prudent to put a stop to arm-to-arm vaccination in plague centres, although there was no evidence that plague could be propagated in this way.

8. *Fevers*, as usual, were the chief cause of mortality during the past as during every year. The deaths recorded as due to them numbered 412,229, being an increase of 23,381 over the number in 1895. It was no more than was to be looked for that, following the scanty rainfall and early cessation of the monsoon, the last three months of the year should enjoy comparative immunity from fever; but it was contrary to expectation that, in face of lessened fever prevalence during these three months when fever is usually most fatal, the total fever mortality of the year should be above the normal. The returns show that deaths from fever were more numerous during October, November, and December of each of the years 1892–93 and 1894 than in the same months of the subsequent years 1895 and 1896. That this greater fatality was due to the more than average rainfall in the three former years, and that the lesser fatality in the two latter years was due to their scanty rainfall, may be accepted as extremely probable. But the cause of increased mortality from fever during the other nine months of 1896 is not so easily accounted for. One explanation offered is that a large number of deaths from other causes during these months was wrongly attributed to fever. But seeing that the same defective diagnosis and record of disease are in operation every year, the explanation does not seem to be quite adequate. A similar high rate of mortality prevailed during the first half of the year in Berar, and was believed to be due to influenza; but of the existence of this disease in the adjoining parts of the Province of Bombay there is no mention, although it is reasonable to suppose that, if influenza was so widely prevalent in Berar as to be sufficient to account for the high death-rate wrongly attributed to fever in the first months of 1896, it may also have prevailed in the districts of Bombay continuous with those of Berar.

9. *Plague* was first diagnosed in Bombay City by Dr. Viegas on the 18th of September. Whether it existed in the town earlier, or whether it was imported, and by what agency, are questions to which answers are not easily given. Its rate of progress at first was not rapid, and 2,908 cases, with 2,086 deaths, were reported up to the end of the year. There may be doubts as to the way by which the disease found entrance into Bombay; but there are none as to how it spread from there into other parts of the country. The first cases of plague which

were detected in Ahmedabad, Poona, and other towns were without exception imported cases. The Sanitary Commissioner is in favour of drastic measures for dealing with plague. "All persons, not "sick but coming, or suspected to come, from an infected area should be put under observation for "10 days. The persons and clothes disinfected both on arrival and departure from camp." In the light of the further history of the progress of plague in India, the Sanitary Commissioner might be disposed to modify his recommendations. The very measures adopted to stamp out the disease have been found, as similar measures have been found in India, to defeat their purpose and aid its propagation. The removal of cholera-stricken persons from their houses to cholera hospitals at once leads to concealment of the disease: similar removal of persons plague-stricken or "suspected" of being so has led to a like result, and in some cases to violent resistance ending in loss of life. Worst of all, it has failed to stop the progress of the disease. "Air, light, and cleanliness appear to have a "great effect on the disease," so writes Dr. Clarkson; and if the inhabitants of affected towns and villages could be induced to submit themselves and their towns and villages to the action of these ordinary agents, more drastic remedies would not generally be required. But the evacuation of large towns and cities for a time by their inhabitants stands on a different level from the evacuation of a plague-stricken village in the Himalayahs. Were it practicable, however, there is little reason to doubt that it would prove as effectual in putting an end to plague in the one case as in the other.

10. Twenty pages of printed matter are devoted to an account of the proceedings of the Sanitary Board. The report is largely taken up with technical details of sanitary works. Probably few readers, other than engineers, would make much of the following quotation taken from page 2 of the Board's report:—"(*e.*) The R.L. of the low-water level of reservoir, and of F.S.L. of No. 1 Cistern, "give a minimum 'head' available of 3·5 feet. The size of pipe to give 42 gallons a minute will be "6 inches in diameter." The omission of the greater part of the details given in the report would not much, if at all, impair its usefulness, and would meet a general desire, which is well expressed in the concluding sentence of the review of the report of the Sanitary Commissioner of the Hyderabad Assigned Districts. "The increasing voluminousness of annual reports has become a serious evil, "and the head of a department who can compress into the fewest and shortest paragraphs an "adequate account of the year's work will deserve, and will certainly obtain, the Resident's "profoundest gratitude."

11. On *Sanitary works*, in the 167 municipalities, excluding Bombay City, out of an income of about fifty-five and a quarter lakhs of rupees, a sum of over twenty-two and a quarter lakhs was expended during the year. Of this latter amount, nearly six and a half lakhs went towards the improvement of water-supply. The account given of the progress being made with the provision of water-supplies for municipalities does not afford much ground for hope that many of the projected works will be undertaken in the near future. Taking the description given of the stage which the water-supply schemes have reached in a few of the municipalities:—*Barsi*, "the water-supply "project for this place has been shelved by the municipality on the strength of an unfavourable "analysis of one well." In *Pandhrapur*, "the much-needed improvements to the water-supply in "the interests of the numerous pilgrims has not proceeded beyond discussion for several years." In *Wai*, "proposals for water-supply and drainage, as in the case of Nasik, have been under discussion "for many years, but have progressed no further." The income of the District Local Boards for the same year amounted to just over forty lakhs of rupees, but less than seven lakhs of this sum was allotted for sanitary purposes. The greater part of the allotment was devoted to the improvement of water-supply. Needless to say, such sums can go but a very short way in carrying out permanent works of sanitary improvement. Want of funds in the Bombay Presidency, as everywhere else, is the main obstacle in the way of sanitary progress.

12. Briefly told, the year 1896 was an unhealthy one. It was characterised by a high maximum temperature, and by a scanty and irregular rainfall. The birth-rate was higher than it was during the preceding year, to the comparative healthiness of which this increase was doubtless due. The death-rate also exceeded that of 1895. High prices and consequent distress prevailed towards the end of the year. Cholera was four times more fatal than in 1895, and small-pox nearly three times. Fever, although less fatal during the months when it is ordinarily most fatal—the last months of the year—has a greater number of deaths recorded against it than during the preceding year. Plague was first recognised in Bombay City on the 18th of September, and slowly increased during the remaining period of the year. From Bombay it was carried into towns in the interior. By the end of the year, 2,908 attacks and 2,086 deaths had been recorded as due to it. Sanitary improvements in municipalities and in rural areas were retarded owing chiefly to a want of a sufficiency of funds. A report of the Sanitary Board covering 20 pages and concerned mainly with technical descriptions of water-works, drainage, &c., might, perhaps, in future be abridged. This would have the effect of reducing the bulk of the Sanitary Commissioner's Report without appreciably lessening its value.

12th October, 1898.

No. 12.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Hyderabad Assigned Districts for 1896.

If the year 1895 was characterised by a light rainfall and an abnormally high maximum temperature, its successor, 1896, presented the same characteristics in a more marked degree. In the former year the rainfall measured 27·3 inches, and in the year under notice only 26·6 inches; whilst the maximum temperature of 1896 was 93·1 as compared with 91·0 in 1895. The mean

maximum temperature was 90·5 and the mean rainfall 40·8 inches during the previous five years. The effects of this short rainfall and high temperature on the crops and on the public health of the province were what might have been anticipated. Partial failure of the autumn, and almost complete failure of the winter, crops followed deficient rainfall; whilst diminution of the malarial diseases, which annually prevail during or after the monsoon, is considered to have been due to the dryness consequent on this lessened fall of rain.

2. *Vital Statistics.*—Attention continues to be given to the inspection of registration of births and deaths. Judging, however, from the recorded results of the inspections made by officers other than those of the Vaccination Department, these inspections, as the Sanitary Commissioner remarks, "often appear to be performed in a very cursory or perfunctory manner." If such really be the case they had probably better not be performed at all; careless testing of them can only tend to breed carelessness in those who keep the registers, by lessening the fear of their shortcomings being found out. A comparison of the entries in the registers with the results of a house-to-house inquiry is the only form of inspection worthy of the name. This method has been followed by the Superintendents of Vaccination, who, during the year have examined 2,872 village registers. Of this number, 240 were found to contain errors of omission, the total of the omissions having been 371 births and 152 deaths. This margin of error, although considerable, is probably still below the reality. Although in municipal towns "it is obligatory for the head of "a family in which a birth or death takes place to report this occurrence," it is found that in most municipalities registration is more defective than in villages—a result which the Sanitary Commissioner believes to be due to a want of interest on the part of municipal authorities. "There is, however," the Commissioner thinks, "some improvement, and 90 persons were "prosecuted during the year for neglect to register, and fines aggregating Rs. 71 were imposed."

3. The *births* were more numerous by 3,061 than during the preceding year; and their ratio per thousand of population increased from 37·2 in 1895 to 38·3 in the year under report. This rate is considerably below the mean of 40·7 for the 10 years ending 1890, and still further below the actuarial estimate for India of 48·8. The preceding two years were distinctly unhealthy, and cannot have failed to exercise an adverse influence on fecundity during 1896. In spite of the persistent efforts to improve registration there is still, as shown by the results obtained by testing the registers, a considerable percentage of births which escape registration.

4. The number of *deaths* fell below the number recorded for 1895 by 17,150; and the ratio per thousand of population from 49·9 to 43·8. In the neighbouring Central Provinces, by which Berar is to a considerable extent surrounded, the reverse was the case, the death-rate rose from 36·75 in 1895 to 49·31 in 1896. Yet, although the death-rate in Berar decreased by 6·1 per thousand of population, it was still largely above the average of 38·8 for the preceding five years. The recorded number of deaths also exceeded the recorded number of births by 13,774. Indeed, for the past three years the deaths have largely exceeded the recorded number of births, and there must be an appreciable reduction of population going on, unless the loss resulting from excess of deaths over births is being made good by immigration, and of this there is no mention. A remarkable feature of the year is the inversion of the seasons of greatest mortality. Instead of low death-rates being recorded during the first five months of 1896, we find the number of deaths rising from 10,573 in January to 13,263 in March, and reaching a maximum of 16,119 in April; whilst in August it has again fallen to 11,796, in September to 10,839; and in October and November to 9,104 and 6,832 respectively. "The healthiest months were June, December, and November, and the most unhealthy "April, May, and March; thus, contrary to previous experience, the first half of the year was the "most sickly, and of the four quarters the fewest deaths were registered in the fourth." The explanation of this anomaly does not appear to be entirely satisfactory. The Sanitary Commissioner writes:—"This deviation from the ordinary in the seasonal incidence of mortality is, I believe, "to be explained by the abnormally hot weather which prevailed during the first half of the year, "operating as a disturbing factor in lowering the public health, and by the exceptionally low "rain-fall in the third quarter, reducing to a minimum those monsoon conditions which tend to "raise the death-rate." With the latter part of this explanation it is possible to agree; exceptionally low rain-fall in the third quarter, or in other words an unusually dry autumn, is consistent with a diminished prevalence of malaria and of the diseases which are attributed to it. But something more than abnormal heat lowering the public health during the first half of the year is required to explain the high mortality in March and April. If this was the cause, we would have expected the mortality to have increased in May and June; whereas the number of deaths fell rapidly from 16,119 in April to 13,375 in May, and to 6,196 in June. If the prevalence of cholera had any connection with the unusual heat in the early months of the year, this might to some extent account for the great number of deaths in March, April, and May. As a matter of fact, to whatever cause due, cholera accounted for 1,055, 2,869, and 2,310 deaths in each of those months respectively. But, although cholera has been shown to have contributed to this high death-rate in the early months of the year, the principal cause was fever. This disease is credited with over 7,000 deaths in each of the months of March and April and over 6,000 in May, as compared with over 4,000 deaths only in each of the ordinary fever months of August, September, and October. Evidently, the Sanitary Commissioner is not himself satisfied with the explanation which has been quoted from his report, for in paragraph 33 he writes:—"This unusual fever mortality during the first "five months of the year is, I believe, attributable to epidemic influenza."

5. *Chief Diseases.*—In every month and in every district cholera was prevalent during the year. The same was the case in the preceding year. An examination of Table 19, page 17, will show that in 1895 and 1896 the general course of the disease was not very dissimilar in both years; and that the number of deaths in each was nearly the same. In the former year it caused 11,919 and in the latter 12,264 deaths. The ratio of deaths per thousand of population was also, of course, nearly the same—4·2 in 1895 and 4·3 in 1896. After these two years of severe cholera epidemics the Sanitary Commissioner ventures on a prediction. "From the experience

" of previous years," he says, " we may expect that 1897 will be one of comparative quiescence of the " disease." In the present state of our knowledge, or ignorance, of the ways of cholera, it is somewhat unsafe to prophesy regarding its future. " After the storm generally comes a calm," writes Dr. Little; but in this instance the subsidence of the mortality in the last months of 1896 will be found to have been delusive, and not to have preceded a calm. A striking feature in the cholera history of the year, it is said, is its seasonal distribution as compared with former years. An examination of the return from which this deduction is drawn does not seem to disclose any very striking feature in the course of the epidemic of 1896 as compared with that of 1895, or with the ordinary course which cholera in Berar generally follows. In 1896 the first two and the last three months of the year are the months of lowest cholera mortality: the same is the case as regards 1895; whilst the mean of the previous 10 years only deviates from this in that the first three and the last two months are those of least cholera mortality. The main difference between the progress of cholera in 1896 and in other years seems to be chiefly in its having increased more rapidly than ordinarily towards its climax in April and May, in this respect bearing some resemblance to its course in 1889. Although the months of August and September were not, as usual, the months of its greatest prevalence, they were still months of great prevalence, the death-rate in each falling little short of the mean for those months. Looking at the table already referred to, the one feature visible in all years is the comparative immunity from cholera mortality of the earlier and of the latter months of each. It may be a question for consideration whether the abnormally high temperature which characterised the years 1895 and 1896 may not have had some influence upon the course of the disease in both years. Certain it is that both years were marked by abnormally high temperatures, and that both were years of severe cholera prevalence.

6. "The reports of first outbreaks from Civil Surgeons do not represent any novel features as " tending to elucidate the mode of origin and spread of the disease;" but evidence is given to demonstrate the acknowledged connection between water-supply and cholera. One sample of such evidence will suffice. Surgeon-Major Roe, Civil Surgeon of Amraoti, after describing how the water-supply of the town of Amraoti gave out early in the year, and stating that cholera began on the 9th of January and ended 10 months later—245 persons having been attacked during this period—goes on to say :—" One interesting point was brought out here. On the 12th February there were 22 attacks, " about 18 of which were among Mahomadans; on the 13th there were 18 attacks, some 14 being " Mahomadans. I then found that the disease was being carried by *bhisties* who supplied water " from dirty *jhiras*, situated in the Amba *nullah*. A guard was placed over the *nullahs*, and " the cholera ceased." We are told nothing about the proportion which Mahomadans bear to the rest of the population: even the number of Mahomadans attacked is vaguely stated to be "about" 18 or "some" 14. It would have been interesting to have been told how Dr. Roe "found that the " disease was being carried by *bhisties*," and also to have had the date given when the guard was placed over the nullahs, and the date on which, following this, cholera ceased. The Sanitary Commissioner observes that the practical failure of the water-supplies was sufficient of itself to raise the death-rate generally, and thinks it very probable that a return to unused wells and river water rendered the people more liable to cholera. There can be little question that the unusual prevalence of cholera was connected with the excessive heat and drought, which rendered the water-supplies of the province scanty and impure.

7. *Small-pox.*—The total number of deaths registered from this disease was 810 as compared with 556 during the previous year. The ratio of deaths per thousand of population was 0·3 as compared with 0·1 the quinquennial mean, and 0·3 the mean of the 10 years ending 1890. The disease cannot, therefore, be said to have been very prevalent or fatal during the year. The single district of Amraoti returns 415 small-pox deaths, or more than half of the total number for the province. But it was discovered that deaths from influenza were being registered under the name of *kapsi matha*, or " cotton-pox," as small-pox; and although the mistake was remedied as far as possible, the Sanitary Commissioner believes that the error led to the recorded number of small-pox deaths being raised somewhat beyond the real number in the Amraoti district. Vaccination made satisfactory progress during the year. The number of operations increased by 12·6 per cent. as compared with the number for the preceding year; whilst the percentage of successful cases in primary vaccination rose from 95·9 to 96·8. On the other hand, the percentage of success in re-vaccination was only 20·5. The contrast between this percentage in re-vaccination and that recorded in some other provinces is remarkable. In Madras, for example, 80·2 of the re-vaccination operations are stated to have been successful. Of every 100 persons vaccinated in Berar 81·1 were infants, and 16·3 children between one and six; whilst only 2·5 were of other ages. Deducting the number of deaths of infants registered during the vaccination year 1896-97 from the total number of children born, there remained 85,879 available for vaccination, and of this number 77,490, or 90·2 per cent., were protected against small-pox by vaccination, leaving an unprotected residuum of 8,389. Dr. Little has found it possible to dispense entirely with arm-to-arm vaccination: calf lymph only is used in Berar. His own experience, he says, is in favour of direct vaccination from the calf; but he thinks the time may come when it will be necessary to carry on vaccination entirely with lanoline paste lymph.

8. *Fevers* are credited with having caused 61,930 deaths as compared with 66,203 in the previous year, and with a mean of 42,124 in the decennial period ending 1890. Ordinarily, fevers are most prevalent and fatal in the months succeeding the setting in of the monsoon, especially in the months of August and September; but during the past year they attained their maximum prevalence in March and April, and their minimum in June and December. The inquiries of the Sanitary Commissioner, as already stated, have led him to attribute this abnormal prevalence of fever in the early months of the year to the epidemic of influenza, which hospital assistants, as a rule, failed to diagnose. The latter disease, as seen by Dr. Little in the villages, was characterised by "sudden " invasion, high temperature, pains in back, limbs, and head, no catarrhal symptoms, great " prostration, and pneumonia as a sequel proving fatal.".

9. *Bubonic Plague.*—Two fatal cases of this disease were reported during the month of October. Both of the persons attacked are believed to have become infected in Bombay, where the disease was prevalent and from which both had just come. Only one of the cases would appear to have been seen by a medical officer. According to the description given by the hospital assistant who saw this case, there can be little doubt that it was one of genuine plague. The body of the deceased was cremated, and the house first occupied by him, as well as that in which he subsequently died were fumigated with sulphur and afterwards lime-washed. There was no other case of the disease in the Buldana district in which this man died. The other man did not apply for treatment; he died on the 11th of October, after suffering from fever and glandular swellings in his groin, since his arrival on the 4th of the same month. He was accompanied from Bombay by two men, three women, and two children. One of the men returned to Bombay; the other six persons are reported to be still residing at Akot, where the man died, and to have escaped infection.

10. *Dysentery and Diarrhœa.*—These diseases were less fatal than during the preceding year, the ratio of deaths due to them falling from 8·6 in 1895 to 6·2 in 1896. Still, the ratio was above the mean of the 10 years ending 1890. Ordinarily, bowel-complaints, like malarial fever, prevail with the greatest severity in the autumn months; but during 1896 their incidence corresponded with that of fever and influenza. It has already been noted that these last were most fatal during the first six months of 1896. The prevalence of bowel-complaints kept time with that of fevers, dysentery and diarrhœa having been unusually fatal during the first five months of the year.

11. *Sanitary Works.*—In Berar, as elsewhere, the want of funds is the main obstacle in the way of a more active prosecution of sanitary improvements. The money available is being chiefly devoted to the provision of a pure water-supply for the towns of the province. Out of a total estimated income of a little less than two and a half lakhs of rupees, the municipalities expended on water-supply Rs. 71,180, besides Rs. 59,988 on domestic cleansing, and Rs. 29,139 on other sanitary works, making a total under these three heads of about 70 per cent. of their estimated income for the year. Sanitary Boards are reminded by the Resident in his resolution attached to the report of the sound "principle that permanent improvements are to be preferred to temporary cleansings." Such advice is timely when it is seen that out of a total expenditure of Rs. 82,695 on sanitary works during the year, no less than Rs. 37,215 were expended on domestic cleansing, whilst only Rs. 28,950 were expended on water-supply, and Rs. 12,690 on drainage.

12. A table is given showing the progress made in his sanitary surveys by the Sanitary Commissioner from the year 1888 to 1896. During the year under report, one town and 152 villages were surveyed, making a total to the end of 1896 of 36 towns and 804 villages. Three more towns and 4,439 villages in the province remain to be surveyed. At the rate of 100 each year, it will take 44 more years to complete the survey of the remaining villages. The proposal of the Government of India to prepare and maintain a permanent sanitary record for villages has been adopted in Berar, and the Resident has directed that the record should be kept in five villages in each district, or in a total of 30 for the province.

13. In the concluding paragraph of our last year's memorandum on the report of the Sanitary Commissioner of the Hyderabad Assigned Districts, when it was proposed that "legislation" should be brought to the aid of sanitary reform, we suggested that education would be preferable to legislation. During the year under review, proposals to legalise a system of village sanitation were, under orders from the Resident, circulated throughout the province for the purpose of eliciting native opinion on the subject. One and all of those consulted "were opposed to any legislative "interference with the customs of the people in connection with sanitary reform. Some of the "more moderate and intelligent native gentlemen are strongly of opinion that the time for "legislation has not yet come, and that to press any measure of sanitary reform in opposition to "the sentiments of the people would give great and universal dissatisfaction." The Sanitary Commissioner adds:—"In deference, therefore, to native opinion, I have withdrawn my proposals "to enforce village sanitation by legislation."

14. Briefly described, the year was one of deficient and unseasonable rainfall, followed by partial failure of the autumn, and almost complete failure of the winter, crops. The unusually high temperature of the year and deficient water-supply are believed to have exercised an injurious influence on the public health. Fever, influenza, and cholera combined to raise the death-rate to an abnormal height during the first half of the year. On the other hand, deficient rainfall seems to have lessened the prevalence of malarial diseases during the last half of the year. What of funds were available were chiefly employed by municipalities in improving their water-supplies. The proposal to enforce sanitary reform in villages by legislation has been, for the present, abandoned in deference to native opinion. The Resident, whilst thanking the Sanitary Commissioner for his report, "begs that in future, earnest endeavours may be made to largely curtail it, and to exclude, as "far as possible, all tabular statements other than those prescribed by authority.

12th October 1898.

No. 13.

Memorandum by the Army Sanitary Commissioner on the Administrative Report of the Town of Calcutta for 1896–97.

Judged by its record of vital statistics, the year 1896 was healthier than its predecessor. There was a substantial increase in the birth-rate, and a still more substantial decrease in the death-rate. In the paragraph sketching the chief meteorological features of the year no mention is made of deviations from normal, nor of the favourable or unfavourable influence exercised by the weather on the public health. The price of food was higher than the average of the preceding ten years.

2. The number of live *births* exceeded the number for either of the two preceding years, but was below the number for 1893. As in the case of Bombay City, the birth-rate in Calcutta is only about half the death-rate. During the year under report, the recorded ratio of births was 18·4, and of deaths 35·7, as compared with 16·0 of the former and 39·6 of the latter in 18.5. An examination of the statement of births on page 290, Part II. of the Report, shows the influence of the disproportion of the sexes in the population on the birth-rate. Where, as in Waterloo Street, there is a population of 6,083, of whom only 500 are females, the recorded birth-rate is 4·4 per mille. In Burra Bazar, with a population of 20,646, of whom the females number only 4,120, the recorded birth-rate is 5·9. In Colootollah, with a population of 50,781, of whom the females number only 15,466, the recorded birth-rate is 9·7. At the same time, this disparity in the number of the sexes is not accompanied by such abnormally low birth-rates in all of the registration circles. For example, in Hastings circle, out of a population of 4,820, only 1,582 are females, yet a birth-rate of 32·1 is recorded: in Collinga, out of a population of 13,218 there are only 4,321 females, and yet the birth-rate is recorded to have been 24·9. It thus appears that, although the preponderance of males in the population has a marked effect, as must always necessarily be the case, in lowering the birth-rate, there may be other influences concerned in bringing about this result.

3. The *death-rate* fell from 39·6 in 1895 to 35·7 in the year under report, but was still almost double the birth-rate. Compared also with the average rate of the five years preceding the unusually unhealthy year 1895, the death-rate of the year under report was still very high. As usual, the death-rate of the Canal area was the highest. This could scarcely be otherwise if the description given of it in the Health Officer's report of last year still holds good. It was then described as low-lying, water-logged, and sewage-logged to a greater extent than any other part of the town. "The decline in the public health," writes Dr. Simpson, "in comparison to the previous five years, "was greater in the town area than in the suburban area, and in the area bordering on the Circular "Canal than in the rest of the suburbs." The tendency of the death-rate of the drained town area to overtake the high death-rate of the undrained suburban area, Dr. Simpson in previous reports attributes to the defects in the drainage system of the former, placing it in the rainy season in much the same position as the undrained suburban area, and to the consequent increase of fever mortality. Infant mortality continues to be lamentably high. Taking the town and suburban mortality combined, the death-rate amongst children under one year of age was 435·4. In the town of Calcutta, taken by itself, almost half of the children born, or 494·7 of every 1,000, died before reaching their first year. Of the male children by themselves, 503·7, or more than half the number born, died within their first year.

4. *Cholera* mortality was largely in excess of that of the previous year. There were 3,449 deaths from this cause, a number not exceeded from the time the records of mortality from cholera in the old town and suburbs were combined in 1889. Such a result, after many years of persistent endeavour to improve the sanitary condition of Calcutta, and the expenditure of vast sums of money in providing it with a pure water-supply, must be somewhat disappointing. But no one who has read the description given by the Health Officer of the sanitary state of the town, even at the present day, will be surprised at the destructive effects of the epidemics of cholera by which it still continues to be visited. Water is doubtless one of the chief means by which the disease is diffused, but it is probably not the only one, and it would be unwise to devote exclusive attention to this one avenue of ingress of the disease to the neglect of others which may seem less important. It would have been interesting to have had some explanation of the reasons why "the added area of Shampooker" had a death-rate from cholera of 8·7 per thousand of its population, and "Collinga Ward" only 1·3. Dr. Simpson endeavours to trace a connection between the use of unfiltered water at the bathing platforms and cholera. He states that a bacteriological examination "showed that *comma bacilli* "were in the river and bathing-platform waters, and that the highest percentage of instances in which "*comma bacilli* were present in the water was practically synchronous with the greatest prevalence "of cholera in the town." It is presumed from this account that those bathing must have drank of the unfiltered water in which they were bathing. Even so, it remains to be proved that the drinking of the water containing the *comma bacillus* caused cholera. So far, the causal relation between the *comma bacillus* and cholera is by no means the established fact which some assume it to be. The Municipal Commissioners resolved to continue the anticholeraic inoculation experiment until the end of the financial year, when operations conducted on their own account ceased. From this decision the inference may perhaps be drawn that anticholeraic inoculation has not achieved the success at first expected by some of its more sanguine advocates.

5. *Small-pox* appears to have expended its virulence during the preceding year, when it carried off no fewer than 2,220 persons. Only 69 deaths were attributed to it in 1896. Until the outbreak of 1895, in no year since 1878 did the number of deaths from small-pox reach a thousand. For the next five or six years, whilst the number of persons unprotected by vaccination is re-accumulating, the disease will probably remain more or less quiescent—again breaking out in epidemic form of a

severity proportioned to the number of persons who have not been vaccinated or re-vaccinated. There was a great falling-off in the numbers vaccinated during the year under report as compared with the numbers in the previous year. The prevalence of small-pox in 1895 had the effect of giving to both primary vaccination and re-vaccination a strong stimulus. The total number vaccinated during the year under report was only 11,976 against 54,982 in the previous year. The percentage of success in ascertained cases of primary vaccination was 95·4, and in re-vaccination 14·3. These latter figures contrast in a remarkable manner with those for Madras City. In Madras the percentage of successful cases in re-vaccination is recorded to have been 87·11. Of children who were vaccinated whilst under one year of age there were 2,936; whilst the number of children born alive was 12,608. Even if half of these latter died in their first year, and the actual number was somewhat less, there would remain available for vaccination 6,304. Of these, it is stated that 2,936 were vaccinated; but from this number should be deducted the unsuccessful cases, the doubtful and the unknown. In Statement III., Vaccination, page 330, Part II. of the Report, the number of cases according to age seems to include all operations, successful or otherwise. It would be a great convenience for purposes of comparison if the Calcutta Municipality would furnish Statement No. 1., showing particulars of vaccination. This is the Statement authorized by the Government of India, and is furnished with the Annual Report of every Province and Presidency town except Calcutta.

6. Although there was a decrease in the ratio of mortality from *fevers* from 16·6 per mille of population to 14·0, yet the ratio was in excess of the average of the five-year period 1891-95 when it was 12·9. The Health Officer gives a table to show that a gradual but steady increase in the death-rate from fevers has been going on in the old town since 1889.

7. When the report of the outbreak of *bubonic plague* in Bombay was confirmed, measures were taken by the Municipal authorities of Calcutta with the object of endeavouring to prevent importation of the disease as well as of stamping it out, should it unfortunately effect an entry into their city. It was discovered that a young man who had come to Howrah from Bombay on the 26th September was suffering from a complaint which the Health Officer and two other medical men pronounced to be *pestis ambulans*; but the "Medical Board, investigating the case later on, came to the conclusion that "there was no evidence to consider this a case of true bubonic plague." The fact that no case of plague appeared in Calcutta for the rest of the year would seem to confirm the accuracy of the Board's finding. The wisdom of some of the proposals made by the Health Officer with the view of protecting Calcutta from an invasion of plague, seems open to question, especially when looked at in the light of subsequent events. He says:—"I went so far as to propose that all passengers, except "first-class passengers whose destination can easily be traced, should undergo detention for seven "days before being allowed to enter Bengal." The reasons assigned for the advocacy of this quarantine measure "are that the conditions, medical, sanitary, and social, are quite different here "from what they are in Europe." The proposals assume that all passengers enter Bengal by railway, and that quarantine can be effectually carried out in India. The first assumption is, of course, untenable, and the second has been found by experience to be impracticable when attempted in the case of other diseases such as cholera. Perhaps in no other country would it be more difficult to enforce effectual quarantine than in India, or in no other country would quarantine rules be so easily evaded.

8. *Sanitary Works.*—One useful result will have followed the fear of an invasion of plague. Calcutta has been brought to recognise the need for expedition in carrying into effect measures of sanitary improvement which, in the absence of the imminence of the danger of such invasion, might have been allowed to stand over until the proverbial more convenient season. "The year, if it were "memorable for nothing else, would be most noteworthy in the history of the town because it has "witnessed the inception and commencement of sanitary works of the highest importance." The first of these is the extension of the unfiltered water-supply. The present supply is said to be insufficient even for street-watering; whilst proper flushing of the sewers is out of the question. "The work now undertaken by the Corporation will, it is hoped, not only greatly improve the state "and efficiency of the existing sewers, but will also render possible connections of private privies "with the sewers, and thus in time largely diminish the night-soil establishment." As regards another of the great sanitary works undertaken during the year, it is said:—"Of equal, or even "greater importance are the works which have been commenced, with a view to improve the outfall "of the sewers of the town proper, to provide for the drainage of the suburbs and of the area between "the Canal and the Circular Road." The foundation-stone of the drainage works was laid by the Lieutenant-Governor on the 26th November 1896. Hardly behind these two great works in importance is the appointment of the Building Commission. The Health Officer thinks this appointment will be "the commencement of a new era in the sanitation of Calcutta, for it is the first serious attempt to "inquire into and deal practically with the ever-increasing irregular growth of the town and the "suburbs, and with overcrowded and unhealthy areas. It is this irregular growth which interferes "with every sanitary reform, and it has reached even for Calcutta to such an extraordinary stage in "Burra Bazar and Jora Bagan, as to render these districts as bad, if not worse, than any to be found "in any eastern city. The condition of the worst of these areas is indescribable." Besides accelerating the inception and prosecution of improvements calculated to exercise a radically salutary influence on the future sanitary condition of Calcutta, the plague scare has given a healthy stimulus to the every-day cleansing of the town.

9. Briefly, the year was healthier than its predecessor: its birth-rate was higher and its death-rate lower. A severe epidemic of cholera carried off 3,449 persons, a number not exceeded since the records of mortality for the old town and suburbs were combined in 1889. The Health Officer connects the outbreak with the presence of the *comma bacillus* in the unfiltered water used at the bathing platforms. Having used up during the previous year the susceptible material available, small-pox was in comparative abeyance and was credited with only 69 deaths. It would be a great convenience in comparing the statistics of vaccination in Calcutta with those in other towns, if the authorized form of Statement No. I., showing particulars of vaccination, were annually submitted by

the Health Officer with his report. There was a considerable decrease in fever mortality in 1896 as compared with its predecessor. The outbreak of bubonic plague in Bombay aroused fears of its importation into Calcutta and active steps were taken to meet the danger. The imminence of the danger of a plague invasion seems to have given a healthy stimulus to the inception and prosecution of much-needed and important sanitary works. The appointment of a Commission to regulate the erection of buildings is regarded by the Health Officer as the commencement of a new era in the sanitary history of the town, and as giving a final check to the perpetuation of the rookeries and slums which are such marked features of Calcutta.

12th October 1898.

No. 14.

Memorandum by the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1896-97.

From a health point of view the history of Madras for the year was uneventful. Although meteorological conditions were abnormal, and the prices of food rose to a great height, especially during the last months of 1896, their influence had no appreciable effect in raising the death-rate, which was practically the same as during the previous year and somewhat below the average for the 10 years 1887-96. The year under report was characterised by excessive temperature and deficient wind, accompanied by short rainfall during the first seven months and excess of rain in the last two months. The rainfall between the middle of October and the end of the year measured 52·9 inches against an average for the same period of 27·6 inches. The price of rice, which was 11 seers for a rupee in January, had risen by the end of the year to eight seers and nine chittacks; whilst the price of *ragi*, a staple food grain of the poor, rose in the same period from 22 seers and three chittacks to 15 seers and eight chittacks. "The prolonged dearness of the staple food grains "cannot but exercise a potent influence on the mortality of the poorer classes, seeing that it is not "counterbalanced by a proportionate rise in the wage of labour." It is pointed out that ever since the setting-in of the series of lean years beginning with 1889 the death-rate has been high. In 1888 the rate was just over 34, and since then has only once fallen below 37 per mille of population.

2. The *births* during 1896 numbered 18,684, exclusive of still-births, and, although in excess of the number for any other year in the decade, were fewer by 453 than in the preceding year. The ratio per thousand of the population of the Census of 1891 was 41·2. The contrast between the birth-rates of the cities of Madras and Bombay is remarkable. In the latter, the recorded rate is 19·33 for the same year, or considerably less than half the Madras rate. In Madras, the number of still-births registered was 504 to 18,684 live-births: in Bombay the number of still-births was 1,598 to 15,890 live births. The difference is striking, and seems incapable of explanation except on the assumption that a large proportion of the live-births in Bombay escape registration. The still-births in Bombay being dealt with as deaths would, as in the case of deaths generally, be more accurately recorded than live-births. It should be noted, however, that, quoting from the Madras Report, "it is probable, judging from the general conditions prevailing in the town, that this figure "(504) is much too low, and that a number of still-births are not recorded." Looking at the statement of births, on the lower half of page 31 of the report, there seems reason to doubt the sufficiency of the explanation given by the President of the cause of the high death-rate of Madras, which began in 1889 and has continued ever since. It is well known that scarcity produces a marked effect in reducing the birth-rate as well as in raising the death-rate; but the birth-rate, instead of declining in the years following 1889, has gone on increasing from a ratio of 35·3 per mille of population in 1888 to a ratio of 42·2 in 1895 and of 41·2 in the year under review. In no year subsequent to 1889 has it been under 36·8. But a high birth-rate, except under special circumstances, is accompanied by a high death-rate; and as the high birth-rate, which we have assumed to be a cause of the high death-rate, cannot be credited to scarcity, it is probable that improved registration may to some extent explain the high death-rate as well as the high birth-rate recorded since 1889. Moreover, the population of Madras is said to be rapidly increasing, and such increase since the taking of the Census of 1891 would have the effect of raising the ratios of both births and deaths above what those ratios would be if calculated on the increased, instead of on the census, population numbers.

3. The *deaths* numbered 17,131, and the mortality ratio, calculated on the Census figures of 1891, was 37·8 per thousand, whilst calculated on the estimated population for 1896 it was only 35·4. The chief causes of mortality were the same during the year under report as during its predecessor. Small-pox, measles, cholera, and bowel-complaints were rather more fatal than during the former year, whilst fewer deaths were credited to fevers.

4. Neither *small-pox* nor *cholera* was excessively fatal, the former having attributed to it 42 and the latter 97 deaths. Of those who died from small-pox, 28 were unvaccinated, seven were said to have been vaccinated, but showed no marks, whilst seven had been vaccinated. Amongst the unvaccinated the proportion of deaths to attacks was 35·4 per cent.; amongst those said to have been vaccinated, but had no marks of vaccination, 17·5; and amongst the vaccinated, 9·7. It is stated that, "out of the 75 unvaccinated who were attacked, 45 were not born in Madras, and nine "were under the age of compulsory vaccination." In a preceding paragraph the number of

unvaccinated who were attacked by small-pox is said to have been 79, perhaps this, and not 75, is the correct number. The ratio of mortality which the 42 deaths from small-pox give per mille of population is only 0·09. Although greater than the mortality for the preceding year, it is nevertheless inconsiderable, and a satisfactory proof of the efficiency of vaccination in Madras. Turning to Statement No. I., Appendix IV., which gives particulars of vaccination in the municipality, it is found that 18,789 successful primary vaccinations were performed during the official year 1896–97, and that 12,929 of these were performed on children under one year of age. The number of living children born in the calendar year 1896 was 18,684. If from this number we deduct the 5,570 deaths of children under one year of age in the same year, we have remaining available for vaccination 13,114. The number of children under one year of age who were successfully vaccinated having been, as already seen, 12,929, there would remain only the small number of 185 unvaccinated; and of these the majority, if not all, may have been found, owing to some form of illness, unfit to undergo vaccination. The quality of the primary vaccination, judging from the high percentage of 99·19 successful cases, could hardly be improved upon. Of re-vaccinations there were 7,828 cases, and of these 87·11 are recorded as having been successful. The number of successful primary vaccinations gives a ratio of 41·5 of the population protected against small-pox, which is slightly in excess of the ratio of births. In addition, 13·31 of every thousand of the population were successfully re-vaccinated. These figures seem to give a satisfactory explanation of the comparative immunity of the population of Madras from small-pox. Such results in a large native population could only be obtained by unremitting effort to enforce the provisions of the Vaccination Act, and it is no surprise to read that "the number of summonses taken out against parents and guardians for omitting to get "their children vaccinated after six months of age was 736." As a consequence of the proceedings taken, 521 of the children were vaccinated; whilst of the rest 48 were found unfit to be vaccinated owing to illness, 86 left the town, 66 prosecutions were withdrawn, seven of the parents or guardians were warned and discharged, and eight children died before the date posted for hearing in the Court. These details are worthy of record as showing that the law relating to vaccination in Madras City is neither allowed to become a dead letter nor administered in the half-hearted manner too common in many other towns in India. The total number of calves inoculated during the year was 638. Of these, six died from chills during the heavy rains of November and December, whilst six died "from "the effects of scarification for the manufacture of glycerized vaccine paste." A total of 12 calves thus died of the 638 used for supplying vaccine lymph. This contrasts very favourably with the mortality amongst the calves provided for the supply of lymph in Assam. In the latter province, of the 435 calves vaccinated during the same year, 20 died before the vesicles developed, and 75 after lymph had been taken from them. For every reason, too great care cannot be taken to prevent the deaths of the calves procured for vaccination purposes. Already there is great difficulty in obtaining a sufficient number; and, if once it gets about amongst the people that many of the calves operated on die at the vaccine depôts, this difficulty will not grow less. The cost of each successful case of vaccination, calculated on the net expenditure, was six annas, and, calculated on the gross expenditure, seven annas. This is high, but the work seems to be efficiently done, and the amount of protection conferred on the population of Madras to be well worth the outlay.

5. *Fevers* "continue to exact a heavy toll on the population, accounting for 6,039 deaths in 1896, "and a much larger number more or less incapacitated for work by sickness." The rise of fever mortality in the hottest part of the year is attributed to chill, the consequence of people sleeping in the open, often on damp ground and without sufficient covering to protect them from the wind. This conclusion is confirmed, it is said, by the fact that many of these cases are complicated by pneumonia. Until the sewerage of the town is effectively carried out, marked decrease in the prevalence of fevers is scarcely to be looked for.

6. Arrangements were made for dealing with *plague* should it break out in, or be imported into, the town; but, fortunately, although there were false reports of its appearance, no genuine case of the disease in either man or rats was reported up to the end of the year. Powers were obtained to enable the authorities to enforce "compulsory isolation, segregation, and disinfection." The practical experience gained in dealing with plague elsewhere, will have taught the need for applying these measures with caution should occasion for their application unfortunately arise. For keeping the plague from gaining a footing, the measures most likely to prove successful are the maintenance of scrupulous cleanliness throughout the town and the relief of overcrowding. For carrying out these measures Madras is in a better position than Bombay, which, besides having nearly twice the population to deal with, is confined within the limits of its island site.

7. *Sanitary Works.*—In the Government review of the report it is said :—"No substantial advance "was made during the year in the sanitary condition of the city; but many useful improvements "have been and are being carried out. The long contemplated scheme for the drainage of the city "has at last been sanctioned, and the Commissioners have undertaken the drainage of Mylapur to "start with." In one of the most insanitary and overcrowded parts of the city, arrangements have been made for laying out new streets. In carrying on the every-day work of conservancy the greatest difficulty is the want of scavengers. These leave their work to cultivate their fields when the rains come, and go to fairs and festivals, where they get higher wages and, no doubt, more congenial employment. It appears, also, that they have learnt the power which combination gives them, and not unfrequently strike work. The public, it is added, find even greater difficulty in obtaining the services of scavengers than the municipality. The application of coercive measures, which would seem to be contemplated under the title of a Labour Law, might not improbably be found to aggravate the trouble which such measures are intended to remedy. It is satisfactory to read that "much more stringency is observed in dealing with applications to build than was formerly the "case." The perpetuation of site-crowding, which constitutes one of the greatest sanitary evils large towns have to contend with, will thus receive a check. The Cooum River nuisance re-appears in every annual report, and is likely to continue to re-appear for many years to come. A scheme, which is estimated to cost 16 lakhs, and has for its object the improvement of the Madras water-supply, is under the consideration of Government.

8. Briefly, the sanitary history of the year was uneventful. The meteorological conditions were abnormal and the prices of food-grains high; but the influence of these factors in raising the death-rate was inappreciable. A birth-rate of 41·2 and a death-rate of 37·8 per thousand of population seem to indicate that the registration of vital statistics is closely supervised in Madras City. Neither from small-pox nor from cholera was the mortality high. That vaccination is efficiently carried out, the best proof is the low rate of mortality from small-pox. Infant vaccination receives special attention; and the provisions of the Vaccination Act are fully utilized to compel parents or guardians to have their children vaccinated within the period fixed by law. Vaccine lymph taken direct from the calf is used, and has given a high percentage of success. Arrangements were made with the object of dealing with plague, but fortunately this disease did not visit Madras. No substantial advance was made during the year in the sanitary condition of the city, but many useful improvements have been and are being carried out.

12th October 1898.

No. 15.

Memorandum of the Army Sanitary Commission on the Administration Report of the Municipal Commissioner of Bombay for 1896–97.

The year 1896 will be memorable for the outbreak in the City of Bombay of bubonic plague. The account given by the Health Officer of the circumstances connected with the first appearance of the disease, and of the measures taken with the purpose of endeavouring to stay its progress, fills the greater part of the Report.

2. The year was in many respects abnormal. The mean annual temperature was 80°, and the second highest on record in the last 51 years. The rainfall was 15 inches above the average; but instead of being distributed over four months it fell within a period of a little more than six weeks. Whilst the fall in June, July, and August largely exceeded the normal, that in September amounted to only 1·6 inches, instead of an average of 10 inches. High temperature, failure of crops, and a rise in the price of food stuffs to over 20 per cent., followed this abnormal monsoon. In his Report for 1893, the Health Officer wrote:—"It has been observed in the sanitary history of this city, that "whenever the season is abnormal, it is followed by a disturbance and an unwholesome state of "public health." In the year under report, scarcity combined with the abnormal nature of the season to produce an unfavourable influence on the public health and to raise the death-rate. Moreover, the scarcity outside Bombay drove numbers of famine-stricken or destitute people into the city, to increase the overcrowding and intensify the distress already prevailing.

3. The *birth-rate* of the year is very briefly dealt with: it did not differ greatly from that of the preceding year, having been 19·33 as compared with 19·08 in 1895. The Health Officer repeats the explanation formerly given of this low birth-rate and attributes it to the disproportion of males to females in the population. But the discovery in a single year by the vaccinators of 5,617 infants under one year of age whose births had not been registered, throws doubt on the sufficiency of this explanation and renders it probable that the low birth-rate is in part due to defective registration. If the latter explanation be accepted, the abnormally high ratio of still-born children in Bombay City would fall to something nearer to the ratio elsewhere prevailing. In the year under review, whilst the recorded number of live-births was 15,890, the number of still-births was 1,598. In coming to a conclusion different from that arrived at by the Health Officer it must not, however, be forgotten that, in the population of Bombay when the census of 1891 was taken, the males were in the proportion of 170·60 to every 100 females. Perhaps the question might be capable of settlement in the same way as a similar question of an abnormally low birth-rate, said to be due to the disparity of the sexes in the population, has been settled in Assam. In some of the towns of that province a census was taken of women of the child-bearing age, assumed to include those between 15 and 39 years, and the probable number of births calculated at the rate of 320 to every 1,000 women. The result was to show that the birth-rate so estimated was greatly higher than the rate calculated on the number of births registered. The table in the report showing the number of births and the birth-rate in each class of the population furnishes examples of violent contrasts. For instance, whilst the birth-rate recorded amongst Brahmans is only 9·18 per mille, and amongst Hindus of "other castes" who constitute more than half of the entire population only 16·73, it is 32·61 amongst low-caste Hindus and 34·45 amongst the Jewish community. Some explanation of the cause of these contrasts might be useful.

4. Exclusive of still-born, 33,451 deaths, equal to a ratio of 40·7 per thousand of population, were registered, being 8,370 more than in the previous year, and 8,267 more than the average. The fact that 19,582, or greatly more than half of those who died, were not born in Bombay, shows to what extent the death-rate of the city was affected by the great migration into it during the year of famine-stricken or destitute people in search of employment or food. A statement giving the number of deaths by months shows that in August there was a marked increase in the number of deaths, and that this increase was due, not to greater mortality amongst the permanent residents of Bombay, but entirely to greater mortality amongst those born elsewhere. Dr. Weir calls especial attention to this increase in the number of deaths in August having been limited to the classes of the population not born in the city, or, in other words, to the immigrant part of the population;

and argues therefrom that, either the increase in mortality was not due, as some would seem to believe, to bubonic plague already prevalent but not yet recognised, or, that if it was plague, the disease affected, not the people of Bombay, but only the classes born outside the city. The figures show that, whilst 1,157 persons born in Bombay died in July, only 1,134 of this class died in August. On the other hand, whilst 1,127 born elsewhere died in July, the number of deaths in this class had risen to 1,514 in August. The month of by far the highest mortality was December, during which 6,131 deaths were registered, or more than twice the number registered during any other month of the year.

5. The contrast between the death-rates of the different classes composing the population is as striking as that between their birth-rates. Amongst Jains the ratio of deaths per 1,000 was 62·83, and amongst low-caste Hindus 63·27 ; whilst that amongst Brahmans was 32·22 and amongst Hindus of other castes 35·77. The birth-rate recorded for Jains was only 15·50 per mille ; so that, if the registration is anywhere nearly accurate, we have a death-rate more than four times greater than the birth-rate. Likewise, as regards Brahmans, whilst their birth-rate is stated to have been 9·18, their death-rate was more than three times greater. As regards low-caste Hindus and Hindus of other castes, constituting between them more than half of the entire population, their death-rates are, in the case of the former somewhat less, and in the case of the latter somewhat more than double their birth-rates. If the births really stand in the proportion of 19·3 to 40·7 deaths, the population of Bombay, unless it were largely recruited from outside, would rapidly diminish and ultimately disappear. A high birth-rate, apart from special conditions, usually accompanies a correspondingly high death-rate ; but in Bombay there is an abnormally low birth-rate accompanying a high death-rate. The high death-rate of Bombay with its abnormally low birth-rate may therefore be taken to indicate a greater degree of unhealthiness than the same death-rate would indicate in a town with a normal birth-rate.

6. The causes of this high death-rate in Bombay City as a whole, and of the exceptionally high rate amongst particular classes of the population, are forcibly described by the Health Officer :— "Excluding the small communities liable to great fluctuations, the highest mortality has occurred "amongst Jains and Hindu low-castes. The high mortality amongst Jains has been greatly influenced "by the occurrence of bubonic plague in this community. The poorer classes of that community "live under very unfavourable sanitary conditions, in over-crowded, ill-ventilated rooms and shops. "Their manner of living is very poor, and a large number are scorbutic. The population is also a "very fluctuating one." As regards Hindu low-castes, Dr. Weir writes :—"Whenever the seasons "are unfavourable and prices of food are high the Hindu low-castes suffer most. They "are very poor, and they may often be seen searching amongst refuse for food. Their "dwellings are in the most crowded buildings of the most crowded localities. Several "families sleep in one room—a domesticity generally unknown amongst other classes. They "usually sleep on the floor on a thin sheet, and in the rainy season the ground on which "they sleep is damp and mouldy, and nearly as damp as the street outside." The Health Officer may well say that there can be on hope for the reduction of the high mortality in these classes until they are provided with more food and with dwellings suitable for human beings. Even when model *chawls* are built for their accommodation, Dr. Weir thinks there will be an inrush of the out-caste population from the country into the city, and that the consequent overcrowding will be difficult to combat. Perhaps under such circumstances the municipality might be justified in preventing the immigration of these swarms of destitutes, or in sending them back to the places whence they had come, seeing that their presence in excessive numbers in the city is productive of misery and a high mortality amongst themselves as well as serious danger to the health of the general population. The interests alike of the immigrants and of the citizens would seem to be served by some measure for limiting the influx of the former.

7. As compared with 1895, the year under report shows an increased mortality from all of the chief diseases. The 4 0 deaths recorded as due to *cholera* give a ratio of 0·60 per mille of population. As observed by Dr. Weir in former reports, the mortality from this disease was least at early periods of life, and increased with age. July and August were the months of greatest prevalence of cholera, 82 deaths having occurred in the former and 137 in the latter. "I ascribe the prevalence of the "disease in July," writes Dr. Weir, "to the abnormal season, and to the development of cholera "germs in the rainy season. A demonstration in favour of the probability of this conclusion is "given in the table showing the mortality in buildings by floors. That table shows that, out of "623 cases, as many as 367 occurred on ground floors amongst people living on damp ground." This differs from the theory usually held that cholera is a "water-borne" disease. However applicable Dr. Weir's theory of causation may be to Bombay, it would hardly account for the violent epidemics which prove so fatal in other parts of India at seasons when the country is parched by excessive heat. Comparing the ratios of deaths amongst those of the population using pipe water with the ratio amongst those using well water, the former is stated to be 78·25 and the latter 90·00. The important conclusion is drawn from the dates on which the first cases of the disease appeared in the different parts of the city, that "the cases did not proceed from district to district, but that they occurred "without regard to the position of the localities, or, in other words, that human communication was "not the condition that influenced the progress and spread of the disease."

8. From *small-pox* there were recorded 701 deaths. Of this number no fewer than 251 occurred amongst children under one year of age. From this the inference might be drawn that infant vaccination was neglected ; but if the return of vaccination on page 607 of the report is examined it will be seen that 13,474 children under one year of age were successfully vaccinated. Now, the total number of children born alive was only 15,890 ; whilst the number of deaths registered of children under one year was 7,273, leaving available for vaccination 8,617. It thus appears that, according to these figures, the number of infants vaccinated was nearly double the number available for vaccination. More than one explanation of this paradox might be suggested. The first that

occurs is defective registration and consequent failure to record a large proportion of the births. Another is the importation into the city of a number of newly-born children. It is known that many women of the native population leave their homes in cities to be confined in the country. In the Infectious Diseases Hospital, Arthur Road, 91 patients who had previously been vaccinated were treated for small-pox, and of these four died; in the same hospital 212 were treated who had not been vaccinated, and of these 68 died. Thus, of the vaccinated the deaths were almost exactly one to every 22 treated, and of the unvaccinated nearly one to every 3 treated.

9. *Fevers* were credited with 8,776 deaths, or 2,372 more than in the previous year. As was only to be expected from the description already given of their condition of life, the Jains and Hindus of low-castes suffered more severely than the other classes of the population. Whilst the ratio of deaths per mille of population for the entire city was 10·68, in the case of the Jains it was 18·15, and of the Hindus of low-castes 17·48.

10. As usual, *phthisis* was very destructive of life, and more especially of female life. Needless to say, "the sections of highest mortality from phthisis are the most overcrowded and ill-ventilated "sections of the city." Regarding the lamentable loss of female life, Dr. Weir writes:—"The "mortality of phthisis by sex shows the enormous loss of female life caused through seclusion "in crowded, ill-ventilated dwellings. The female mortality from phthisis is more than double "the male, and this excess of mortality falls chiefly on the Mussulman and high-class Hindu "female."

11. Of *bubonic plague* in Bombay there is an interesting account, illustrated by numerous diagrams and covering 159 pages. The history of the disease is carried into 1897. We can do no more here than touch a few of the points relating to the year under review. The existence of plague in the city was first recognised towards the end of September by Dr. Viegas. The preceding month was characterised by excessive rainfall. "The heavy rainfall in 1896, as we remember, flooded with "sewage the low-lying portions of the city, through which the polluted streams rushed in whirling "currents, leaving banks of mud and sludge behind to ferment or slowly dry; and moreover the "sewage flowed from the sewers on to the streets after each heavy downpour, and rushed up the "traps and flowed on to the low-lying ground. Unfortunately, in the beginning of the monsoon, a "serious obstruction occurred on the Worli foreshore, in the outfall channel of the sewage." The foregoing description is not dissimilar, as Dr. Weir observes, from that given by Gibbon of the events which preceded the pestilence from which Rome suffered towards the end of the sixth century. Regarding the immediate origin of the plague in Bombay there are many theories, but nothing is known with certainty. Whatever was the cause of the disease, the Health Officer makes it clear that the circumstances preceding its appearance were such as to favour an outbreak of sickness. Of these, the chief were the inundation of the low-lying parts of the city with sewage, and the influx of swarms of starving immigrants from the country, who added to the already existing overcrowding. Fever with glandular swellings was no new disease in Bombay, and the Health Officer says with regard to its recurrence in 1896, and the measures taken to prevent its spread:—"I believe we would have been as successful as at other times, had the rats "not been infected, and had the year not been abnormal, and food scarce and dear." This would seem to suggest belief in a local origin, as opposed to importation of the disease. The period preceding the outbreak was not only unhealthy as regards human beings, but is shown to have been marked by an increased mortality amongst the lower animals as well.

12. Immediately it became clear that genuine plague had to be dealt with, the utmost promptitude and energy were shown by the Health Department in the effort to stay its progress. One of the earliest measures adopted was the provision of an adequate staff for the purpose of searching out cases of the disease and having them promptly segregated. This measure excited much hostility and opposition among the people, as might have been expected by those conversant with the customs and caste prejudices of the natives, and its modification was soon found to be expedient. Another measure of great importance was the disinfection of buildings in which cases of plague had occurred. No less important was the emptying of infected buildings, and the opening up, when practicable, of such buildings to the action of light and air by removal of portions of their roofs and other suitable means. Stores of grain were exposed to the air, and when found to be unwholesome were destroyed. The panic amongst the inhabitants which followed the drastic remedies adopted by the authorities led to the flight of thousands from the city into the country, and to the importation of the disease into places hitherto free from it. There was a fear that the panic might extend to the scavengers, in which event the city would have become uninhabitable from the accumulation in it of the unremoved filth. But the fears of the people were somewhat allayed by the modification of the segregation rules, and the work of cleansing and disinfection continued to be vigorously prosecuted. "We treated houses practically as if they were on fire," writes Dr. Weir, "discharging into them "from steam engines and flushing pumps quantities of water charged with disinfectants."

13. Up to the end of the year the number of deaths recorded as due to plague was 1,936; but doubtless this only represents a part of the real number. In spite of the utmost vigilance of the medical and sanitary staff the concealment of cases of illness and of deaths was sure to take place when it became known that everyone suffering, or even suspected of suffering, from the disease would be removed to a hospital. The enormous increase in the death-rate during December is suggestive. The number of deaths recorded in November was 2,889: in December it was 6,131. This necessarily brief sketch may fittingly conclude with a quotation from the account of the epidemic given by the Health Officer:—"And yet an unprejudiced judgment on the progress of the "disease and the effect of the measures adopted to check it affirms the wisdom of all ages as handed "down to us, that the disease spreads most surely and rapidly where the overcrowding of buildings "on the ground surface is greatest, and where buildings are closest together and where least air and "light enter. A free current of air is most fatal to the growth of the bacillus in dwellings, and a

" wholesome body and a hopeful disposition most unfavourable to the growth of the disease in " human beings. In dwellings a pure atmosphere and in human beings a vigorous constitution are " the best allies against the pestilence. We have gained experience ; let us profit by it in the " future."

14. *Summary.*—The year was, from a meteorological point of view, abnormal : the temperature was higher than the average and the rainfall greatly in excess of normal. Whilst, ordinarily, the rainfall is distributed over four months, it was concentrated within little more than six weeks in 1896. The premature cessation of the rains was followed by crop failure and scarcity. The recorded birth-rate was slightly higher than it was in the preceding year, and less than half the death-rate, which was 40·7 per mille of population. The chief diseases were more fatal than in 1895 ; but cholera was credited with only 490 deaths and small-pox with 701. Although 251 deaths from small-pox occurred amongst children under one year of age, the number of infants successfully vaccinated, judging from the returns, was much in excess of the number available for vaccination, estimating this number by deducting the number of deaths amongst children under one year of age from the recorded number of births. The high rate of mortality from phthisis may be taken as one of the indications of the overcrowding and defective ventilation of the dwellings in which the victims of the disease resided ; whilst the excessive mortality caused by it amongst females illustrates the baneful effects of the seclusion in close rooms to which, more especially, Mussulman and high-caste Hindu women are subjected. Fevers were unusually fatal, a fact which may suggest incomplete registration of deaths from bubonic plague. This last disease was first definitely recognised towards the end of September, and, in spite of the most vigorous measures adopted to stay its progress, continued to spread in the City of Bombay during the rest of the year. Moreover, the panic which followed the enforcement of segregation caused an exodus of thousands of the inhabitants into the country and the importation of disease into other towns by the fugitives.

12th October 1898.

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ON

SANITARY MEASURES IN INDIA

IN

1897-98.

VOL. XXXI.

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A. GODLEY,
Under Secretary of State for India.

INDIA OFFICE,
October, 1899.

REPORT.

The present Report on Sanitary Measures in India during the year 1897 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population ; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1897.

The health of the European troops on service in India in 1897 was not so good as in the previous year. On an average strength of 68,395, the admissions into hospital were in the ratio of 1,557 per 1,000, against 1,387 in 1896, the daily sick-rate rose from 94 to 101, and the death-rate from 14·84 to 22·93. The invaliding ratio (33) was higher by 5 per 1,000, so that the total loss by death and invaliding was equal to 56 per 1,000, an increase of 13 per 1,000 on the previous year.

The Presidential Army system was abolished in 1894, and the whole of the forces in India is now designated the Army of India, divided into the Bengal, Punjab, Madras, and Bombay Commands. This organization took effect from the 1st April 1897.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands during 1897 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1897	20,113	1,619	113	23·32	41	64
	1896	22,457	1,436	100	18·70	29	48
Punjab	1897	17,190	1,460	93	21·52	22	44
	1896	18,823	1,282	84	13·60	26	40
Madras	1897	12,369	1,354	104	13·10	48	61
	1896	13,488	1,336	99	9·79	33	43
Bombay ...	1897	14,859	1,508	92	14·33	32	46
	1896	15,716	1,485	92	15·14	24	39
INDIA ...	1897	68,395	1,557	101	22·93	33	56
	1896	70,484	1,387	94	14·84	28	43

It will be seen from the above statement that of the four Commands Bengal had the highest daily sick and death rates. The Madras Command was again the healthiest, and its death-rate was not much more than half that of Bengal.

The chief causes of sickness in the whole European Army were, as in the year 1896, venereal diseases and ague, the former yielding a ratio of 486 per 1,000 against 512 in 1896, and the latter 395 per 1,000 against 239. More than half (56 per cent.) of the total sickness resulted from these two causes. Enteric fever, as usual, was the chief cause of mortality, and the death-rate from it was 9·01 per 1,000 against 6·31 in 1896. This fever yielded over 39 per cent. of the total deaths.

Groups of stations.

The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,202	1,474	117	11·65
Burma, Inland	2,678	1,512	106	10·83
Bengal and Orissa	2,269	1,501	95	19·39
Gangetic Plain and Chutia-Nagpur	6,833	1,513	108	25·17
Upper Sub-Himalayan	13,508	1,504	100	18·21
North-Western Frontier, Indus Valley, and North-Western Rajputana.	4,983	1,782	104	24·48
South-Eastern Rajputana, Central India, and Gujarat.	6,150	1,959	128	33·01
Deccan	8,865	1,457	101	13·99
Western Coast	1,471	1,154	77	11·56
Southern India	3,177	1,393	94	15·11
Hill Stations	7,058	1,245	98	14·17
Hill Convalescent Depôts	3,156	1,138	88	14·89

Of the above 12 groups, five returned a higher daily sick-rate than the ratio for the whole European Army, the highest being 128 per 1,000 of average strength in South-Eastern Rajputana, Central India, and Gujarat group. The Burma Coast group came next with a ratio of 117, followed by the Gangetic Plain and Chutia-Nagpur and Burma Island groups with ratios of 108 and 106 respectively. The lowest ratio (77) was returned by the Western Coast group. The death-rate of the entire Army was exceeded by three groups, viz., South-Eastern Rajputana, &c., the Gangetic Plain and Chutia-Nagpur, and the North-Western Frontier, Indus Valley, and North Western Rajputana groups.

Of the stations with a strength of over 1,000, five returned death-rates above 20 per 1,000, viz., Agra 57·90, Peshawar 46·24, Meerut 24·45, Mhow 23·00, and Umballa 22·75.

Cholera.

The mortality from cholera in the European Army was higher than in 1896. The admissions to hospital from the disease numbered 117 or 1·7 per 1,000 of average strength, against 70 or 1·0 per 1,000 in 1896, and the deaths rose from 63 or 0·89 per 1,000 to 80 or 1·17.

Small-pox.

Among the whole of the European troops in India there were during the year under notice only 24 cases of small-pox ; of these four were fatal. In the previous year there were 122 cases and ten deaths.

Fevers.

From intermittent fever the admissions to hospital among the European troops in 1897 were in the ratio of 395 per 1,000 of strength, against 239 in the previous year. The death-rate under this head was 0·41 per 1,000, against 0·10 in 1896.

From enteric fever the admissions rose from 1,795 or 25·5 per 1,000 of strength to 2,214 or 32·4, and the deaths from 445 or 6·31 per 1,000 to 616 or 9·01. Of the four Commands Punjab recorded the highest mortality under this head, viz., 11·05, followed by Bengal with a ratio of 10·39, Bombay 6·46, and Madras 4·93. Among the larger stations with an average strength of over 1,000, Agra returned a death-rate from this fever of 45·04, Peshawar 26·93, Meerut 18·58, Mhow 16·95, Umballa 15·32, Allahabad 14·34, and Lucknow 11·93, and in four other stations the ratios ranged from 8·77 to 6·60. As usual, young and unacclimatised soldiers were the chief sufferers ; among those from 20 to 25 years of age the death-rate was 12·74 per 1,000 against 9·52 in 1896, while among men between 25 and 30, and from 30 to 34, the mortality was 4·98 and 2·77 per 1,000 respectively. Among men of less than one year's residence in India

the death-rate from this fever was 18·50 per 1,000, among men between one and two years 10·79, and among troops between five and ten years' service the rate was 2·98 per 1,000.

Bowel complaints.

The admissions from dysentery and diarrhœa among the European troops were in the ratio of 79 per 1,000 of strength, or 33 per 1,000 more than in 1896. The mortality from dysentery was in the ratio of 2·53, and from diarrhœa 0·23 per 1,000. Dysentery was most prevalent in the Madras Command.

Plague.

There were five cases of plague among the European troops in 1897, but none of them were fatal.

Venereal diseases.

Venereal diseases, as usual, came first in the list of causes of admission to hospital; and also in the causes of invaliding. They were the cause of 31 per cent. of the total sickness during 1896, and over 29 per cent. of the invaliding of the European Army of India. The ratio of admissions from venereal diseases per 1,000 of strength was 485·7 or 25·9 below that of 1896. Dr. Harvey, Sanitary Commissioner with the Government of India, states that this reduction appears to have been connected with the employment of a large number of men on field service in the second half of the year, as the number of venereal admissions was much lower from July to December than from January to June. In spite, however, of the fall in the general ratios in 1896 and 1897, the admission-rate from secondary syphilis continued to rise, and in the year under notice reached 101·9 per 1,000, being the highest on record. The admission-rate from venereal diseases was highest in the Bengal Command, viz., 600 per 1,000, next came Madras with a ratio of 542, Bombay with 475, and the Punjab with 404, but only in Bombay was there a decrease. The number of men constantly sick in hospital from these diseases was 2,992, against 3,162 in the previous year, being equivalent to about three regiments; and the average stay of a case in hospital was 33 days. "Such figures," the Army Sanitary Commission state, "may be left to tell their own tale. Those who are not convinced by them of the "alarming ravages of venereal disease amongst our young soldiers, and of the urgent need "for the adoption of effectual measures for holding it in check, would not be convinced "by any description of the physical ruin it inflicts on its victims and on their posterity. "A visit to the wards of the Netley Hospital might help to dispel the doubts of those "who still continue to regard with scepticism the official figures showing the havoc "annually wrought by venereal disease amongst the soldiers of the European Army of "India." The deaths from these diseases numbered 23, and the invalidings 662, against 14 and 479 respectively in 1896.

Invaliding.

The loss to the whole army by invaliding during 1897 amounted to 2,258 men, equal to 33·01 per 1,000, against 1,966 or 27·89 in 1896. The proportion of invalids to strength was highest in the Madras Command (47·5), followed by Bengal (40·9), Bombay (31·8), and Punjab (21·9). Of the total number invalided, 34 per cent. were discharged as unfit for further service, being 5 per 1,000 lower than in 1896. As regards the influence of age and length of residence in India upon invaliding, 63 per cent. of the total number invalided were under 25 years of age, against 62 in 1896, while 32 per cent. were of less than two years' service, and 85 per cent. were of less than five years' service. In the European Army as a whole 84 per cent. of the total strength had seen less than five years' service.

II.—NATIVE ARMY.

Sickness and mortality in 1897.

There was more sickness and greater mortality in the Native Army of India during 1897 than in 1896, which is attributed to an increase of malaria owing to an abundant monsoon after a long period of drought.

The ratios of sickness and mortality among Native troops in the six Commands during 1897 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1897	26,644	834	33	9·12
	1896	26,279	809	31	8·52
Punjab	1897	35,454	867	31	13·26
	1896	38,824	766	29	14·37
Madras	1897	23,588	710	32	9·45
	1896	25,009	665	31	8·04
Bombay	1897	26,421	822	27	10·48
	1896	24,707	880	28	8·82
Corps of Central India and Rajputana*	1896	5,062	630	20	10·47
Hyderabad Contingent	1897	6,554	551	19	6·26
	1896	6,970	563	19	7·03
INDIA	1897	129,802	839	32	13·12
	1896	128,826	763	29	10·20

* Since 1896 these corps have been distributed between and absorbed into the Bengal and Bombay Commands.

Of the five Commands the Punjab again returned the highest rate of mortality, though the figures show an improvement on those of 1896. Pneumonia was very prevalent in this force, and the death-rate from it was 4·29 per 1,000, or about a third of the total mortality.

The chief cause of sickness in the Native Army was ague, which caused 41 per cent. of the total admissions. Among the diseases from which the admissions to hospital were higher than in 1896 were enteric fever, dysentery, and ague ; while from influenza, small-pox, scurvy, cholera, and respiratory diseases there was a decrease in the admissions. There was considerably less influenza among the Native troops in 1897 than in the previous year, and the admission-rate fell from 10·7 per 1,000 of average strength in 1896 to 5·4. From venereal diseases the admission-rate in the Native Army was only 40·8 per 1,000 of strength, as compared with 485·7 per 1,000 among European troops. Figures under this head are not available for the years before 1877. The ratios run at a much lower level than those of European troops, and there is not the same tendency to increase. Only twice since 1877 has the ratio reached 40 per 1,000, viz., in 1890, when the admission-rate was 41·1, and in the year under notice.

Respiratory diseases were the chief causes of death in the Native Army, and no less than 24 per cent. of the total deaths were due to them. The death-rate under this head was 3·23 per 1,000 of average strength, against 3·72 in 1896. From pneumonia alone the mortality among the Native soldiers (2·73 per 1,000) was nearly five times as great as that among European troops (0·60 per 1,000). Fevers of all kinds were the cause of 14 per cent. of the total deaths, against 44 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 1·72 per 1,000, while among the European troops the proportion was 1·02.

On the other hand, the death-rate from enteric fever among the Native troops was only 0·12 per 1,000, as compared with 9·01 among the European troops. From cholera there were 68 deaths in the Native Army, equal to 0·52 per 1,000 of strength, as compared with 88 and 0·69 respectively in 1896.

During 1897 there were 131 cases of plague among the Native troops with 81 deaths, against 2 cases and 1 death in 1896.

The following statement gives the principal statistics of the Native Army arranged in geographical groups for 1897 :— **Groups of stations.**

——	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	2,215	690	29	4·51
Burma, Inland	5,354	784	37	7·47
Assam	1,791	1,066	45	12·84
Bengal and Orissa	3,059	935	38	6·21
Gangetic Plain and Chutia-Nagpur	6,295	618	27	9·53
Upper Sub-Himalayan	14,704	697	27	8·43
North-Western Frontier, Indus Valley, and North-Western Rajputana.	15,270	1,132	35	13·56
South-Eastern Rajputana, Central India, and Gujarat.	12,203	784	28	7·38
Deccan	19,137	729	26	12·75
Western Coast	2,808	760	32	8·55
Southern India	8,229	612	33	9·36
Hill Stations	20,430	973	37	14·39

In five of the above groups the daily sick-rate was lower than that for the whole Native Army, and in two the mortality was greater. The highest mortality was that of the Hill Stations group (14·39), which shows an increase of 4·14 per 1,000 on the rate for the previous year.

Of the large stations with a strength of over 1,000, the following recorded the highest death-rates: Belgam 34·31, Dharmsala 25·60, Edwardesabad 24·78, Poona 21·05, and Dehra Dun 20·75.

III.—GENERAL POPULATION.

The year 1897 was a trying one from a health point of view. Failure of the rains of 1896 led to scarcity and famine, the effects of which told severely on the poorer classes, and resulted in most provinces in a diminished birth-rate and a high death-rate. Great anxiety was also occasioned by the plague, which happily was confined chiefly to the Bombay Presidency.

Vital statistics.

Births were registered throughout all the 10 provinces in India in 1896, and the birth-rates varied between 42·6 and 20·24 per 1,000 of population under registration. The best results were obtained in the Punjab, Berar, Bengal, Bombay, Assam, Lower Burma, and the North-Western Provinces and Oudh, their respective rates being 42·6, 39·7, 36·9, 33·5, 32·6, 31·8, and 31·1. In the remaining provinces the birth-rates ranged between 28·7 in Madras and 20·2 in Coorg. Berar was the only province which recorded a higher birth-rate than in the previous year. The birth-rates exceeded the death-rates in four provinces, the excess per 1,000 varying between 11·5 in the Punjab and 3·3 in Madras. The recorded deaths rose from 6,779,016 or 32·05 per 1,000 of registered population in 1895 to 7,645,257 or 36·03. With the exception of Bengal and the Punjab, the mortality recorded in the several provinces was higher than in 1896. Of the chief diseases, cholera was much more prevalent, and the total number of deaths from it rose from 469,667 to 550,768. The increase was spread over six of the provinces, but Assam, the Central Provinces, and Madras were the chief sufferers, their death-rates from this cause being 6·62, 6·01, and 4·4 per 1,000 respectively, against 3·39, 5·58, and 1·5 in 1896. There was an increase also in the deaths from fevers, which was participated in by all the provinces except Bengal. In connexion with this cause of death the scheme for the sale of quinine at a low price by postal agency continued to make steady progress. The mortality from dysentery and diarrhœa was considerably higher than in the previous year ; and from small-pox there was an increase of 27,275 deaths.

The deaths from the chief diseases and from all causes in the several provinces were as follow :—

	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1897.	1896.
Bengal	196,247	2·76	19,655	0·27	1,679,132	23·62	53,822	0·75	2,341,632	32·94	34·17
North-Western Provinces and Oudh.	44,208	0·94	87,127	1·86	1,463,716	31·21	58,822	1·25	1,897,592	40·46	33·32
Punjab	622	0·03	16,077	0·78	422,826	20·57	15,851	0·77	638,227	31·05	31·53
Lower Burma	8,538	1·89	1,950	0·43	51,752	11·46	8,793	1·95	118,570	26·26	23·63
Central Provinces	57,131	6·01	3,641	0·38	389,335	40·98	81,092	8·53	658,822	69·34	49·31
Coorg	106	0·61	59	0·34	7,182	41·50	538	3·11	8,658	50·03	26·43
Assam	33,240	6·62	5,420	1·08	144,307	28·74	23,136	4·61	254,093	50·61	36·33
Madras	143,445	4·4	21,678	0·7	292,292	9·0	38,716	1·2	827,525	25·4	20·6
Bombay	57,109	3·03	3,835	0·20	452,596	24·05	85,966	4·57	749,916	39·84	31·69
Berar	10,122	3·5	617	0·2	65,611	25·0	29,549	10·3	150,222	52·6	43·8
Total	550,768	2·59	160,059	0·75	4,968,749	23·34	396,285	1·87	7,845,257	36·06	32·05

Bengal.

The year 1897 in Bengal was on the whole healthy, notwithstanding the prevalence of scarcity and famine. The number of births registered in the province fell from 2,703,486 or 38·03 per 1,000 of population in 1896 to 2,625,844 or 36·94, the latter being made up of district rates varying from 47·40 in Malda to 28·97 in Pabna and 18·46 in Calcutta. The decrease in the provincial birth-rate, Dr. Dyson, the Sanitary Commissioner, attributes to the scarcity which prevailed from October 1896 to September 1897, and which lowered the vitality of the people and reduced their fecundity. Of the 46 districts there was an

increase of births in 19, the greatest advance being in Balasore, where the ratio was 8·61 per 1,000 in excess of the previous year. Purnea followed with an increase of 6·45, 24-Parganas of 5·68, Jessore of 5·55, and Malda of 5·06. Out of 147 towns only 11 returned a birth-rate in excess of 40 per 1,000, while 17 rural areas returned rates of over 50 per 1,000, and 65 others over 45 per 1,000.

The total number of deaths registered during the year under notice was 2,341,632 or 32·94 per 1,000, as compared with 2,428,830 or 34·17 in 1896. There was thus an excess of births over deaths of 284,212 or 4·0 per 1,000. The district death-rates ranged from 49·46 in Chittagong to 23·88 in Singhbhum. In urban areas the rate of mortality fell from 36·14 to 35·09, which was made up of ratios varying from 89·59 in the small municipality of Bhadreswar in Hooghly to 14·20 in the municipality of Maniktola in the 24-Parganas. Twelve out of the 147 towns returned a death-rate in excess of 50 per 1,000, and 18 in excess of 40 per 1,000, while 24 returned rates below 25 per 1,000. In rural areas the death-rate fell from 34·07 to 32·83. Chakaria in Chittagong district returned the enormously high death-rate of 152·94, which was due to 5,377 people having perished during the cyclone of 24th October.

Of the chief death causes cholera was again widely prevalent in 1897, but the number of deaths registered from it fell from 226,824, or 3·19 per 1,000, in 1896 to 196,247 or 2·76. Every district was affected by the disease, but the mortality varied greatly, and the number of villages attacked was 29,776, or 13·26 per cent. of the total, against 27,460 or 12·23 per cent. in 1896. Nine districts recorded cholera death-rates of over 5 per 1,000, viz., Puri (9·57), Chittagong (8·35), Lohardaga (8·02), Manbhum (7·00), Palamau (6·61), Cuttack (5·86), Hazaribagh (5·48), Backergunge (5·24), and Faridpur (5·18) ; in 20 other districts the rates ranged from 4·88 to 2·08, and in eight districts the rates were below 1 per 1,000. As regards the seasonal incidence of the disease in each of the main geographical divisions of the province, the seasons of highest mortality in Bengal proper were April, March, and June ; in Behar the rates were highest in August, June, and July ; in Orissa during July, June, November, and August ; and in Chota Nagpur in August, July, September, and June.

From small-pox the mortality was much higher than in 1896, the number of deaths having risen from 13,388 or 0·19 per 1,000 to 19,655 or 0·27 in 1897, or by nearly 50 per cent., an insignificant rate, however, when compared with those from other diseases prevalent in Bengal. The disease was present in all the districts except Jalpaiguri, but the only districts in which it can be said to have prevailed in an epidemic form are Shahabad (1·97), Puri (1·95), and Gaya (1·21). The prevalence of the disease in Shahabad was attributed to the large number of unprotected labourers who came to the district during the famine in search of work ; and in Puri infection was said to have come from the adjoining district of Ganjam in Madras Presidency.

About three-fourths of the total deaths were recorded under fever, a term which "covers a multitude of complaints in the minds of the village chaukidar, who is primarily "responsible for registration, and it is certain that numerous deaths are put down to "fever which are really due to other causes." Still, there is no doubt that fever claims more deaths than any other disease. The number of deaths reported to have occurred from fever during the year was 1,679,132 or 23·62 per 1,000 of population, against 1,760,225 or 24·76 in 1896. Out of the 46 districts, 22 recorded a higher fever mortality than the provincial rate, six registering a rate over 30 per 1,000, Pabna and Hazaribagh coming first with rates of 35·57 and 35·26 respectively. The high rate of Pabna was attributed to the scanty rainfall, and to the filthy and stagnant ditches and the Tarai tracts with which the district abounds. In Hazaribagh malarial fever is reported to have prevailed considerably in September, "when for a few weeks throughout the district it was very "widespread, more so than in most years, and rendered very fatal by the debilitated "condition of the people, owing to the many months of privation they had passed through, "unwholesome jungle produce chiefly forming the food of large numbers during the late "famine."

From dysentery and diarrhœa 53,822 deaths were registered, equal to 0·75 per 1,000 of population, against 47,935 or 0·67 in the previous year. Of the districts, Lohardaga returned the highest death-rate from these causes (4·96), Calcutta came next (4·72), followed by Puri (4·08), Howrah (3·97), and Darjeeling (3·86). With the exception of Lohardaga these districts have headed the list, though in a different order, for the last four years. The increase in mortality under this head was, it is said, almost solely due to the prevailing scarcity among the poorer classes, who were "obliged to live on herbs, "roots, leaves of trees, and other unsuitable and unwholesome food."

In Calcutta the birth-rate was identically the same as in 1896, viz., 18·46 and 18·49, and there was but little difference in the death-rate, that for 1897 being 36·18, as compared with 35·73 in the previous year. There was an increase in mortality under all the chief death causes except cholera, from which the deaths fell from 3,449 to 2,349. Five hundred and sixty-three anti-choleraic inoculations by M. Haffkine's method were performed during the first three months of 1897, after which the Corporation discontinued the grant for this purpose. There were 161 deaths from small-pox, as compared with 69 in 1896. It is noteworthy that during the last three months of the year the town was absolutely free from small-pox. The deaths from fever rose from 9,564 in 1896 to 9,619, the death-rates (14·0) being the same in both years. From dysentery and diarrhœa the deaths also rose from 2,967 in 1896 to 3,218 in 1897.

North-Western Provinces and Oudh.

The exceptional conditions of the year in consequence of the scarcity and distress which prevailed in certain parts of the North-Western Provinces and Oudh are strongly reflected in the vital statistics. "The year now closed," the Sanitary Commissioner (Dr. Thomson) writes, "has been one of exceptional trial. It is a history of patient and quiet endurance "on the part of the people, and of much anxious work on the part of those entrusted with "the care of their welfare. The mortality, though far below what might have been "reasonably expected, has been, in the nature of things, high." In addition to famine plague effected an entrance into the province in April, but prompt measures were taken to prevent the disease securing a permanent footing, and only 73 deaths were reported.

During the year 1,458,947 births were recorded, giving a ratio of 31·10 per 1,000 of population, as compared with 1,660,387 or 35·40 in 1896. Of the total 48 districts 22 showed a birth-rate above and 26 below the average of the provinces. Bulandshahr headed the districts with a birth-rate of 50·74, followed by Etah 47·48, Aligarh 46·02, Muzaffarnagar 43·73, Meerut 41·78, and Bareilly 41·35. The birth-rate in municipalities was 34·77 against 39·30 in the previous year, and was made up of extremes ranging from 51·96 in Kandhla to 9·56 in Naini Tal.

The number of deaths registered rose from 1,562,894 or 33·32 per 1,000 of population in 1896 to 1,897,592 or 40·46, and exceeded the births by 438,645 or 9·36 per 1,000. The provincial death-rate, which was made up of district rates ranging from 62·07 in Hamirpur to 23·67 in Garhwal, was exceeded in 25 districts. The death-rate in municipalities was 49·01 against 40·73 in 1896. In several municipalities the rate of mortality was considerably above the average; but this was mainly due to the municipalities being "the situation of poor-houses, to which the beggars, lepers, and the generally submerged "portion of the population came too frequently only to die." Out of 104 municipalities 76 recorded more deaths than births. Registration was again tested by local authorities, and the results disclosed an omission of 2·79 per cent. on 148,015 births, and 2·43 on 179,149 deaths; and in cases tested by the Vaccination Department the omitted percentages were 0·84 of births and 0·62 of deaths.

Of the chief diseases, cholera was less fatal by 24,939 cases than in 1896, the total deaths from the disease numbering 44,208 or 0·94 per 1,000, as compared with 69,147 or 1·47. Though the mortality was above the average in some districts, there were no excessive ratios, and three districts were free from the disease. Pilibhit recorded the highest district rate of 3·21, followed by Jalaun 3·03, Hamirpur 2·86, Banda 2·72, and Sitapur 2·16. The reduced mortality under this head is the more satisfactory, as from the accumulation of large bodies of workers on famine relief work an increase might have been expected. More deaths from cholera were recorded in August than in any other month, the number reaching 7,978, closely followed by 7,534 in July, and 7,317 in June. The disease declined with the cold weather, and in December 797 deaths were reported. All the large fairs in the province passed off without the appearance of epidemic disease.

From small-pox the mortality was more than double that of the previous year, the deaths reaching 87,127 or 1·86 per 1,000, against 42,771 or 0·91 in 1896. The epidemic was widespread in character, and the explanation for its increase "is possibly to be found "in the peculiar climatic conditions of the year." Famine districts were not particularly affected. In Sultanpur district, where the death-rate was highest (5·98), the rural circles have shown for some years past a very low percentage of vaccinations; and Jaunpur, which recorded the next highest rate (5·57), is also said to be badly protected. Bijnor came next with a ratio of 5·32, followed by Budaun, Partabgarh, Rae Bareli, Hardoi, and Mirzapur with ratios of over 4 per 1,000.

To fevers were ascribed 77 per cent. of the total deaths. The mortality from fever in 1897 was much higher than in the previous year, the number of deaths having risen

from 1,205,964 or 25·71 per 1,000 to 1,463,716 or 31·21. Among the districts, Bareilly came first with a fever death-rate of 48·65, followed by Hamirpur 48·11, Jalaun 47·85, Agra 46·72, Pilibhit 42·63, Hardoi 40·73, and Lucknow 40·61. Five other districts recorded ratios above the provincial rate. The mortality reached its maximum in October and the minimum was in June. Dr. Thomson remarks that in a year like 1897 it is impossible to dissociate fever and famine as factors affecting the death-rate, and that it is unsafe to definitely say more than that malarial fever was of a severe type, and that the people generally were, from a reduced condition of health, less able than usual to withstand it.

The deaths from dysentery and diarrhœa during 1897 numbered 58,822, an increase of 17,964 on the mortality of the previous year, the death-rates being 1·25 and 0·97 respectively. Among districts, Garhwal recorded the highest ratio of 5·91, followed by Banda 4·69, Fatehpur 4·39, Jhansi 4·36, and Almora 3·82. "Excepting the hill tracts," Dr. Thomson states, "which always show large ratios from these diseases, the explana-" tion no doubt lies in the exposure necessarily attendant on the congregation of large " bodies of workers on relief works."

Punjab.

Notwithstanding the prevalence of scarcity and an outbreak of plague, the year 1897 in the Punjab was on the whole a healthy one. The number of births registered was 874,623 or 42·6 per 1,000 of population, as compared with 884,692 or 43·04 in 1896. The birth-rate was again higher than that of any other province in India, and was made up of district ratios ranging from 57·5 in Jhang to 19·3 in Simla and 30·5 in Peshawar. Further improvement was made in the registration of births in the frontier districts, except in Peshawar and Hazara. The provincial birth-rate exceeded the death-rate by 11·6 per 1,000 of population, and in ten districts the excess was considerable, ranging between 25·3 and 15·0 per 1,000; while there were only three districts (Hissar, Dera Ismail Khan, and Simla) in which the deaths exceeded the births.

From all causes 638,227 deaths were registered during the year, giving a death-rate of 31·05 per 1,000, against 648,099 or 31·53 in 1896. The highest district rates were reported from Dera Ismail Khan 50·18, Hissar 45·31, Muzaffargarh 44·25, Bannu 43·03, Karnal 40·83, and Jhang 40·37, the remainder varying between 37·36 in Gurgaon and 21·89 in Gujrat. With the exception of the outbreak of plague noticed below, no disease of an unusual character prevailed, and there was a marked diminution in the mortality from cholera and small-pox.

The province suffered very little from cholera, only 622 deaths from this cause having been recorded as compared with 5,146 or 0·25 per 1,000 in 1896. Twenty-six of the 31 districts were free from the disease, and in the remainder it was severe only in the famine-stricken district of Hissar, where 538 deaths occurred, being equal to a death-rate of 0·69 per 1,000. The entire province was quite free from cholera until June, in which month 11 deaths were recorded, rising in July to 160, and falling each subsequent month, until in November and December the province was again free from the disease.

The severe epidemic of small-pox which visited the province in 1896 and caused a mortality of 45,084 and a death-rate of 2·19, which was the highest reached in any year since 1879, diminished during the year under notice to 16,077 or 0·78. All the districts were affected, but the disease was most fatal in Bannu, with a death-rate of 3·82 per 1,000, followed by Hazara with a ratio of 2·38 per 1,000, and by five other districts whose death-rates were above 1 per 1,000. Of the total 16,077 deaths from this disease 31 per cent. were infants under one year of age, and 53 per cent. were children between the ages of 1 and 12.

The deaths ascribed to fevers numbered 422,826, giving a death-rate of 20·57 per 1,000, against 393,535 or 19·15 in 1896. The provincial rate was exceeded by 19 out of the total 31 districts, the highest being Dera Ismail Khan 40·49, Muzaffargarh 37·99, Hissar 34·23, Bannu 32·71, Dera Ghazi Khan 31·15, and Jhang 26·56. Malarial fever was the cause of the high mortality in these districts.

From dysentery and diarrhœa 15,851 deaths were registered, being equal to 0·77 per 1,000 of population, against 13,886 or 0·68 in 1896. Eight districts recorded a higher mortality under this head than the provincial rate, the highest being Hissar 2·02, Simla 2·01, Gurgaon 1·89, Delhi 1·38, and Kangra 1·11.

Plague appeared in the province in an epidemic form during the year. The disease first appeared in Khatkar Kalan, a village in the Jullundur district. By the end of the year it had attacked four other villages, and proved fatal in 175 cases out of a total of 302.

Central Provinces.

The year 1897 in the Central Provinces was exceptionally unhealthy. The famine which began in November of the previous year reached its climax in 1897, and during

the first two quarters of the year the numbers on relief rose till they reached 7 per cent. of the population. In the last quarter all immediate traces of the famine had disappeared, and by the end of the year all relief operations had been closed. The vital statistics of the year were the most unfavourable ever recorded. The registered births were fewer by 46,454 than in 1896, the number having declined from 301,427 or 31·72 per 1,000 to 254,973 or 26·83, the lowest rate recorded since 1881, and the lowest of all provinces in India except Coorg. In 14 of the 20 districts fewer births were registered than in the previous year. "There can be no doubt," the Chief Commissioner again remarks, "that the birth-rate affords a certain indication of the extent to which "distress is affecting the working classes. It is only where the numbers in receipt "of relief never exceeded 0·35 per cent. of the population that the birth-rate of the year "exceeds the death-rate."

The deaths of the year numbered 658,822 or 69·34 per 1,000, against 468,469 or 49·31 in 1896. This abnormal mortality was in great part due to widespread and destructive epidemics of cholera and fever. The number of deaths exceeded the decennial mean by 372,832 and the death-rate was more than double or 39·38 above the mean. The provincial death-rate was exceeded in nine districts, viz., Mandla (98·36), Bilaspur (95·54), Saugor (87·25), Balaghat (86·95), Raipur (78·55), Narsinghpur (78·48), Betul (73·54), Jubbulpore (72·15), and Seoni (71·57).

Cholera was again exceptionally prevalent, and was fatal in 57,131 cases as compared with 52,985 in 1896, the death-rates being 6·01 and 5·58 respectively. The excessive death-rate of the year from cholera was exceeded only in 1869. The disease prevailed in every district of the province, but it was most severe in Mandla (11·62), Raipur (10·04), Bilaspur (9·87), Narsinghpur (7·50), Damoh (7·02), and the provincial mean was exceeded in four other districts. Only in the district of Burhanpur was the mortality less than 1 per 1,000. May and June were again the most fatal months, when 15,642 and 21,125 deaths respectively were recorded.

Small-pox was less prevalent than in the previous year, and the deaths fell from 7,747 or 0·82 per 1,000 in 1896 to 3,641 or 0·38. The disease was widespread and affected every district without exception. In proportion to population the districts of Bilaspur, Sambalpur, and Raipur suffered most, their ratios of mortality being 0·73, 0·89, and 0·92 respectively. In no other district was the mortality above 0·50 per 1,000. The disease prevailed as usual with the greatest intensity in the hot months and declined in the monsoon season. Of the total small-pox deaths about one-fourth (888) occurred among infants, and 1,428 were children under 10 years of age.

Nearly 60 per cent. of the total deaths were ascribed to fevers, and the number registered during the year was 389,335 or 40·98 per 1,000 of population, against 280,760 or 29·55 in 1896. "The term fevers," the Sanitary Commissioner (Dr. Hutcheson) writes, "is "very indefinite as regards the cause of death; and much of the general mortality "from a great variety of causes is included under this head. In fact, owing to "the ignorance of the reporting agency, the term is frequently used to indicate the "cause of death generally, and may be, and is, applied to diseases with no relation to, or "connected with, specific or malarial fevers." The provincial death-rate from fever was exceeded by nine districts, with ratios of mortality ranging from 60·77 to 41·26. The average town death-rate under this head was 29·16, against 22·65 in the previous year.

From dysentery and diarrhœa the registered mortality rose from 29,882 or 3·14 per 1,000 of population in 1896 to 81,092 or 8·53, a mortality "clearly indicating the severity and "extent of the late famine, and the distress and suffering which affected a large proportion "of the population." The highest death-rate under this head was recorded by the Murwara district (24·14), followed by Mandla (23·12), Jubbulpore (17·99), Narsinghpur (14·03), Damoh (12·54), Hoshangabad (11·99), Seoni (11·54), Balaghat (10·70), and Saugor (8·75). The mortality from these causes was excessive in every month of the year and greatest in August and September.

Burma.

Births and deaths continued to be recorded throughout Lower Burma and in four municipal towns of Upper Burma. It is proposed to introduce the system of registering deaths into the more populous and civilised areas of Upper Burma from the beginning of 1899. In the area under registration in Lower Burma 143,659 births were recorded in 1897, giving a birth-rate of 31·82 per 1,000 of population, as compared with 145,688 or 32·27 in 1896. That there is still much room for improvement is shown in the variations in the district rates, which ranged from 40·97 in Sandoway and 40·43 in Pegu

to 17·61 in Rangoon. The number of deaths registered was 118,570, giving a death-rate of 26·26 per 1,000 of population, against 106,687 or 23·63 in 1896. By districts the ratios ranged from 14·44 in Mergui to 38·33 in Rangoon. The death-rate was the highest on record, and was attributed to better registration. With a view to further improvement amended rules have been issued for the collection and record of statistics of births and deaths, and, in the opinion of the Lieutenant-Governor, "the system of registra-" tion now appears to be theoretically perfect, so far as it can be, having regard to the nature " of the agency employed."

Of the chief causes of mortality, cholera was much more active and widespread than in 1896, and the number of deaths rose from 2,959 or 0·66 per 1,000 to 8,538 or 1·89. All the districts were visited by the disease, except Sandoway, Tavoy, and Mergui, but the epidemic was most severe in the Irrawaddy and Pegu divisions, which were responsible for 3,886 and 2,586 deaths respectively. Cholera was present throughout the year, the months of greatest mortality being March, April, May, and July, when it took a downward course and reached its lowest ebb for the year in December. It is reported that nowhere in Upper Burma did the disease appear in an epidemic form during the year.

Deaths from small-pox were slightly more numerous than in 1896, viz., 1,950 or 0·43 per 1,000, against 1,669 or 0·37. Of these, 375 or 19 per cent. were infants and 890 or 46 per cent. were children over one and under 12 years of age. Pegu (1·60) and Toungoo (1·36) were the only instances in which the small-pox death-rate reached 1 per 1,000. In two out of the three districts of the Arakan division no deaths were recorded from this disease, while in the other (Akyab) there was only one death; the district of Tavoy was also free, and Mergui had only one death. Unprotected cooly immigrants from India are reported to be a prolific field for the propagation of this disease, and proposals for remedying the evil were under consideration; but in the majority of cases inoculation is said to be responsible for outbreaks of the disease.

Deaths ascribed to fever rose from 51,521 or 11·41 per 1,000 in 1896 to 51,752 or 11·46, a higher number than had been recorded in any previous year. By districts the death-rate was highest in Sandoway (19·10), Toungoo (17·08), and Akyab (16·35). In six other districts the provincial rate was exceeded, and in the remainder the rates ranged from 10·39 to 7·74. The town death-rate from fever was 7·53 and the rural rate 12·05, as compared with 8·39 and 11·87 in 1896.

The deaths registered under dysentery and diarrhœa during the year aggregated 8,793, giving a death-rate of 1·95 per 1,000, against 7,777 or 1·72 in 1896. The highest mortality under this head was recorded by Toungoo 3·61, followed by Bassein 3·35, Rangoon 3·28, and Thaton 3·14; in the remaining 14 districts the death-rates ranged from 2·42 to 0·36.

Registration of vital statistics in Assam is still very defective. The total number of births registered during the year 1897 was 163,617, giving a ratio of 32·59 per 1,000 population, as compared with 169,172 or 33·69 in 1896. The highest birth-rate was again recorded by Goalpara district, viz., 45·52, followed by Sylhet and Lakhimpur with a rate of 35·17 each, and Cachar 33·04, these being the only four instances in which the provincial rate was exceeded, as the rates of the remaining districts ranged from 29·85 in Sibsagar to 19·77 in Nowgong. **Assam.**

The year was exceptionally unhealthy and the deaths registered during 1897 aggregated 254,093, exceeding the births by 90,476 and the mortality of 1896 by 71,676. The death-rate was 50·61 per 1,000 of population, as compared with 36·33 in 1896. In the Surma Valley, comprising the districts of Cachar and Sylhet, the average mortality rose from 35·43 in 1896 to 54·21, both districts contributing to the increase. In the Brahmaputra Valley the average death-rate was 46·97, as compared with 37·39 in the previous year. Of the six districts in this division Golpara recorded the highest mortality of 50·53 per 1,000, followed by Nowgong with 50·40, the ratios of the remaining four districts ranging from 47·67 to 41·72.

The high mortality of the year was greatly due to a severe outbreak of cholera in the Brahmaputra Valley where the deaths from the disease rose from 7,586 in 1896 to 23,620. The total number of deaths from cholera in the province during 1897 was 33,240 or 6·62 per 1,000, against 17,042 or 3·39 in 1896. The disease prevailed throughout the year and visited every district. Some of the districts recorded a very high cholera death-rate, notably Kamrup and Goalpara in the Brahmaputra Valley, their respective rates, being 17·48 and 10·35, against 1·49 and 3·44 in 1896. In the two Surma Valley districts (Cachar and Sylhet) the rates were respectively 6·31 and 3·36. The average death-rate from cholera in the towns was 15·44 per 1,000, against 6·43 in the country. In some of

the towns the cholera death-rates were excessively high, especially in the Sadr towns of Tezpur and Dhubri, which registered 62·08 and 58·86 respectively.

Cholera was again very prevalent among tea-garden coolies who travelled up the Brahmaputra Valley in steamers. Among them there were 474 deaths; and 934 deaths occurred among the coolies at the depots, after landing.

The mortality from small-pox was almost the same as in the previous year, the deaths numbering 5,420 or 1·08 per 1,000, against 5,444 or 1·09. The highest rates were returned by Sibsagar (5·10), Lakhimpur (2·27), and Kamrup (2·06). In the Sadr and sub-divisional towns, in most of which vaccination is compulsory, the small-pox death-rate fell from 1·27 to 0·50 per 1,000. Of the total small-pox deaths, nearly 20 per cent. occurred among infants, and nearly 53 per cent. among children between the ages of 1 and 12 years.

About 57 per cent. of the year's mortality was ascribed to fevers, including kala-azar. The number of deaths registered from them was 144,307, representing 28·74 per 1,000 of the population, against 101,347 or 20·18 in 1896. The increase occurred chiefly in the Surma Valley where in Sylhet district the death-rate rose from 15·71 in 1896 to 30·89, and in Cachar from 12·76 to 35·30. But the highest fever death-rate was again recorded by Nowgong, viz., 41·77. The provincial fever death-rate was also exceeded by Goalpara (34·72) and Darrang (30·30). Of the 18,612 kala-azar deaths, 12,012 occurred in the Nowgong district, an increase of 1,424 on the number of the previous year. Owing to the high mortality from kala-azar in Nowgong, and its continued prevalence in other places, a specialist (Surgeon-Captain Rogers) was appointed in 1896 to investigate and report on the disease. The result of his enquiry shows that the disease is not, as had been supposed, identical with anchylostomiasis, and that its symptoms are in no way different from those of a very intense form of malarial fever, and that it is communicable. He recommends segregation and quarantine and the abandonment of infected sites. Steps have been taken to induce the people of the affected tracts to adopt the remedial measures recommended by Dr. Rogers for checking the spread of the epidemic, but hitherto without much success.

Under dysentery and diarrhœa 23,136 deaths were registered, yielding a ratio of 4·61 per 1,000 of population, as compared with 16,004 or 3·19 in 1895. As usual, these diseases were most prevalent in Lakhimpur district, its death-rate under this head being 11·66. The next highest rates were 8·97 in Sibsagar district, 8·24 in the Khasi and Jaintia Hills, and 7·34 in Cachar district. The unusually high death-rate from these diseases in the Khasi and Jaintia Hills is stated to have been due to the effects of exposure after the earthquake.

Madras.

The number of births registered in Madras Presidency during the year was 935,845 or 28·7 per 1,000, against 979,981 or 29·9 in 1896. The decrease extended to 15 of the 22 districts, and was attributed by the Sanitary Commissioner, Dr. King, to the influence of famine in certain areas, and deferred marriages owing to the unfavourable state of agricultural prospects. Excluding Madras town, which recorded a birth-rate of 41·6, Chingleput again registered the highest ratio of 37·1, and in six other districts the rate was above 30 per 1,000, while in Ganjam and Malabar the rates were only 23·9 and 20·8 respectively. Among the 59 municipalities, 8 recorded birth-rates over 40 per 1,000, 14 over 35, and 20 over 30 per 1,000. The mortality in 1897 exceeded that of the previous year by 151,738, the deaths having risen from 675,787 or 20·6 per 1,000 to 827,525 or 25·4. By districts the highest death-rate was recorded in Ganjam, viz., 50·1, followed by Madras 35·4, which was less by 2·4 per 1,000 than that recorded in the previous year. In the other districts the mortality ratios ranged from 31·6 per 1,000 in Vizagapatam to 19·3 in Salem. The average death-rate of the towns was 31·9 per 1,000, and that of rural areas 24·8.

Of the chief diseases, cholera was considerably more fatal than in 1896, the number of deaths having risen from 47,847 or 1·5 per 1,000 to 143,445 or 4·4. All the districts were affected, but the disease was most severe in Ganjam and Malabar, which recorded cholera death-rates of 12·5 and 10·4 respectively. The Sanitary Commissioner states that in both these districts the predisposition of the population was increased by conditions of scarcity, and that the medical officers maintain that diarrhœa of a character simulating cholera was due to the eating of unripe food by the people. The next highest death-rate from cholera was 7·5 per 1,000 in Tanjore, followed by 6·0 in Madura, and 5·9 in Anantapur; in the remaining districts the rates varied from 4·7 in Kurnool to 0·3 in Madras. The average death-rate in municipal and other towns from the disease was 5·0 per 1,000, against 2·3 in 1896, and that in rural tracts 4·3, against 1·4.

Small-pox deaths were reported from all the districts, and the total in the whole Presidency aggregated 21,678 or 0·7 per 1,000, against 9,410 or 0·3 in 1896. Of the districts, the disease was very severe in Ganjam, which returned 14,515 or about two-thirds of the total. The disease was also severely felt in Anantapur and North Arcot, while in Malabar, where it was most destructive in previous years, there were only 43 deaths. Of the total 21,678 small-pox deaths 4,573 or over 21 per cent. occurred amongst children under 1 year of age, and 10,120 or nearly 47 per cent. among those between 1 and 12 years of age.

From fevers the registered deaths rose from 260,769 or 7·97 per thousand to 292,292 or 9·0. The excess mortality from fevers occurred in the last seven months of the year, the deaths up to June having been fewer than in the previous year. "The comparative "freedom in the early part of the year," Dr. King states, "must be ascribed to the "diminished soil moisture proving inimical to the propagation of the malarial germ, in "consequence of failure of the north-east monsoon of the previous year; this was followed, "on access of moisture with the south-west monsoon, in the presence of a population "rendered susceptible to malaria owing to diminished food supply, by a mortality greater "than normal under this head." The highest district rates were recorded in Vizagapatam (23·8), Ganjam (19·2), Kurnool (18·1), and the Nilgiris (17·0); four other districts had ratios of over 10 per 1,000, and ten over 5 per 1,000. Nine of the 59 municipal towns returned fever death-rates exceeding 10 per 1,000, the highest being 21·7 in Kurnool, followed by 14·2 in Bellary and 13·9 in Vaniyambadi.

The number of deaths registered under dysentery and diarrhœa in the Presidency was 38,716 or 1·2 per 1,000, an increase of 3,914 on the mortality of 1896. The excess was contributed by 13 of the 22 districts, of which seven were formally recognised as suffering from famine, whilst in the others there was considerable distress. Of the districts, Madras came first with a death-rate from this cause of 4·5, against 5·3 in the previous year, followed by Malabar with 3·3, and South Canara with 3·2; three other districts had ratios of 2 per 1,000. Of the towns, Bimlipatam recorded the high death-rate of 8·5 per 1,000, followed by Cochin 7·8, and Coonoor 7·2. Owing to the continued presence of these diseases in Coonoor, Dr. King urged on the municipal authorities the adoption of a sound water supply scheme, "if it did not wish the fame of Coonoor as a sanitarium "to pass away from it for ever."

Bombay.

The year 1897 in the Bombay Presidency was again an unhealthy one. "The plague "and famine," the Sanitary Commissioner (Surgeon Lieutenant-Colonel Clarkson) writes, "which had visited the Presidency in the latter half of the year 1896, continued on in "1897, and great suffering and a high death-rate has resulted. The plague continued "throughout the year, but owing to the timely rainfall, especially in September, the "cultivators were encouraged to return to till their fields, and the famine works closed "except in three places."

In the Presidency, including Sind, 629,693 births were registered during the year, giving a birth-rate of 33·46 per 1,000 of population, as compared with 691,247 or 36·76 in 1896. Of the 24 collectorates and districts only three recorded higher rates than in the previous year, the remainder showing a decrease, especially Bombay City, where the birth-rate, usually low, was rendered still lower by the exodus of the people on account of plague. More children were registered as still-born in Bombay City than in any other district, and the percentage of still-born to born alive was 14·88. The causes are the same as those mentioned in previous reports, viz., overcrowding on unhealthy areas and living in badly ventilated rooms, to which may be added the kind of work women have to labour at.

The total number of deaths registered in the Presidency rose from 596,742 in 1896 to 749,916, and the rate per 1,000 of population from 31·69 to 39·84, which was made up of district ratios ranging from 58·88 in Bombay City to 15·92 in Hyderabad. The increase of 153,274 deaths was spread over all the districts except six, and was common to all the specified causes of death. The excess was most marked in Bombay City, Poona, Nasik, and Satara, in all of which plague was virulently epidemic. The month of greatest mortality was August, when 82,743 deaths were registered, after which the mortality gradually lessened.

Of the chief diseases, cholera was more prevalent than usual, owing to the famine, and caused 57,109 deaths, giving a ratio of 3·03 per 1,000, as compared with 35,404 or 1·88 in 1896. The province of Sind was practically free from cholera, only one death being reported (from Karachi district) during the year. All the other districts were affected.

The epidemic was specially severe in Satara, Poona, Belgaum, Bijapur, Sholapur, Kolaba, Ahmednagar, and Nasik districts, the ratios of which ranged from 9·03 to 4·04 per 1,000. Many of the towns recorded high rates, the highest being 26·63 in Nasik and 12·32 in Pandharpur in Sholapur district. Deaths occurred in every month of the year, the months of greatest prevalence being May to August; the maximum of 14,749 was reached in August.

Small-pox deaths fell from 6,443 or 0·34 per 1,000 in 1896 to 3,835 or 0·20. Every district was affected, but only in two did the death-rate reach 1 per 1,000, the highest rates recorded being 1·13 in Broach and 1·01 in Thar and Parkar. According to age, 29·46 per cent. of the small-pox deaths occurred among infants under one year of age, and 46·39 per cent. among children between the ages of 1 and 12.

The number of deaths registered in the Bombay Presidency as due to fevers was 452,596 or 24·05 per 1,000 of population, against 412,229 or 21·90 in 1896. The average rate was exceeded in 11 districts, among the highest being 33·35 in Bombay City, 32·22 in Poona, 32·15 in Satara, and 31·93 in Nasik. The increase of 40,367 was shared in by 12 out of the 24 collectorates. As regards the monthly distribution of deaths due to fever, the Sanitary Commissioner states: "In spite of the plague, the fever mortality which was "noted as low in the last three months of the year 1896, continued below the figures of the "corresponding months of the previous year up to the end of May 1897, but exceeded "the 10-year mean. In June the lowest fever mortality for the year (31,018) is as usual "reported, though it is higher than that of the corresponding month of the previous year "(29,255), and the corresponding decennial period (25,737). After June a rise takes "place, and the maximum mortality is reported in August (44,547), and continues high "till the end of the year."

The number of deaths ascribed to dysentery and diarrhœa aggregated 85,966 or 4·57 per 1,000 of population, against 36,046 or 1·92 in 1896. In all but two of the 24 districts the mortality was higher than in the previous year, the greatest increase being in Sholapur, where the death-rate under this head rose from 2·36 to 12·22. Poona came next with 9·70 against 2·69 in 1896, followed by Nasik with 9·32 against 4·73, and in 7 other districts the rates were higher than the average for the Presidency. "There is no doubt," the Sanitary Commissioner writes, "that the large rise in mortality from dysentery and "diarrhœa is due to famine. In areas where the famine most prevailed the mortality "is seen to be the highest, and those areas upon the fringe of the famine the death-rate "is also high."

From plague 46,944 deaths were reported during the year, giving a ratio of nearly 2·5 per 1,000 of population. The outbreak commenced in September of the previous year, at the end of which 2,086 deaths had been reported, being equal to a ratio of 0·12 per 1,000. Up to the end of 1896 ten of the 24 districts had remained free of the disease, but in spite of precautions to check its progress, plague had extended to all but two (Kanara and Panch Mahals) of the districts by the close of 1897, though some were but slightly affected. Of the 46,944 deaths, Bombay City contributed 10,237, Satara district 10,031, and Poona district 8,871. An interesting account of the history and progress of the plague and of the measures taken to suppress it, will be found in the Abstract of the Report of the Sanitary Commissioner with the Government of India, at pages 107–136.

Berar.

The public health of Berar in 1897 was not satisfactory, owing chiefly to the effects of the famine. The total number of births registered in the course of the year was 113,364 or 39·7 per 1,000 of population, showing an increase of 4,351 or 1·4 on the previous year. But although there was a rise in the provincial birth-rate as compared with 1896, the increase was confined to the first six months of the year, "before the effects of the "famine had had time to diminish the fecundity of the population," as towards the end of the year the birth-rate fell considerably. In the six districts of the province the birth-rates ranged from 40·4 in Akola to 37·0 in Basim.

The deaths rose from 124,787 or 43·8 per 1,000 in 1896 to 150,222 or 52·6, a rate which has only been exceeded once since the commencement of registration in 1868, and then only in the famine year of 1878, when the excessive rate of 81·5 was recorded. The increase occurred chiefly under dysentery and diarrhœa, which accounted for 11,827 of the excess mortality. Amraoti district recorded the highest death-rate, 61·1; Akola came next with 55·5, Ellichpur 54·9, Buldana 54·2, Basim 43·5, and Wun 42·1, which was the only case of a decrease on the previous year's death-rate (50·5). The high death-rate of Amraoti district as compared with others was attributed to its close proximity to the Central Provinces, from which the starving poor flooded the

district seeking for work and food. "Numbers of these people," it is reported, "died "from the effects of chronic starvation from which they suffered before reaching Berar, "with the result of unduly raising the death-rate." In municipalities, the average death-rate rose from 43·4 in 1896 to 54·5, which was made up of ratios ranging from 91·9 to 21·8.

Cholera, though again epidemic during the year, was not so prevalent as in 1896, as the deaths fell from 12,264 or 4·3 per 1,000 of population to 10,122 or 3·5. The disease affected every district, and prevailed throughout each month of the year. According to districts, the highest death-rate was recorded in Akola, where there were 3,244 cholera deaths, equal to a ratio of 5·6 per 1,000, against 1,424 or 2·5 in 1896. Amraoti came next with a cholera death-rate of 4·4. Of the 38 towns only four escaped the disease, and in 24 of these the death-rates exceeded the average for the province. Out of a total of 5,658 villages cholera prevailed in 596 or 10·6 per cent., as against 704 in 1896.

From small-pox, 617 deaths were registered, giving a ratio of 0·2 per 1,000 of population, as compared with 810 or 0·3 in 1896. More than half the deaths (318) were registered in Akola district, and the fewest (11) in Ellichpur district. Although the disease was present in several towns, it attained serious proportions in very few. Seventy per cent. of the deaths occurred amongst children under 12 years of age, 191 or 31 per cent. being infants under one year.

Under fevers, a mortality of 65,611 or 23·0 per 1,000 was registered, against 61,931 or 21·8 in 1896. By districts the death-rates from fever varied between 30·6 in Wun and 18·0 in Basim. Notwithstanding the general increase in the provincial mortality from fevers, there was a considerable falling off in the admissions under this head in the medical institutions which is explained by the fact that a large proportion of the deaths occurred amongst the famine-stricken poor, "with whom the question of medical relief "was secondary to that of food wherewith to sustain life, and who did not resort to the "dispensaries for medical treatment."

The number of deaths attributed to dysentery and diarrhœa was 29,549 or 10·3 per 1,000, against 17,722 or 6·2 in 1896. Ellichpur district, as usual, recorded the highest mortality under this head, viz., 16·4, against 10·3 in the previous year. Akola followed with 13·0, which was also higher than the ratio (8·0) of the preceding year. The other district rates ranged from 12·7 in Amraoti to 2·7 in Wun.

IV.—JAILS.

Sickness and mortality in 1897.

The general state of the public health and the meteorological conditions of the year 1897 were unfavourable to the jail population of India. Scarcity and famine, consequent on the drought of the previous year, had so affected the public health that a great proportion of prisoners admitted to jail were in a weak and emaciated condition. Scarcity and high prices led to an abnormal influx of prisoners, and consequently there was much overcrowding in the jails. The daily average sick per 1,000 of average strength fell from 39·54 in 1896 to 39·31, while the ratio of admissions into hospital rose from 939 to 975, and the death-rate from 27·79 to 39·64. There was an increased mortality in all the provinces except Assam, where the jail death-rate fell from 50·86 in 1896 to 48·69. From cholera there were 436 deaths, as compared with 142 in 1896. In the jails of the Punjab, Berar, and Coorg there were no deaths from this disease.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1897, as compared with the previous year :—

Provinces.	1897.			1896.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,083	26	34·4	1,154	39	28·78
North Western Provinces and Oudh.	1,019	50	35·47	897	51	28·83
Punjab	1,340	31	16·3	1,237	31	15·68
Burma	596	29	24·04	759	35	18·19
Central Provinces	1,233	65	134·98	1,108	40	72·11
Assam	1,255	51	48·69	1,128	51	50·86
Coorg	479	11	25·21	1,042	31	20·85
Madras	672	30	47·45	583	25	19·51
Bombay	807	26	35·28	861	32	31·89
Berar	550	16	34·77	594	18	25·13
India	975	39	39·64	939	40	27·79

Bengal.

The statistics of the Bengal jails for 1897 show that there was less sickness among the jail population of the province, with an increased mortality. The admissions into hospital were in the ratio of 1,083 per 1,000 of average strength, against 1,154 in 1896, the average daily sick-rate was 26 or 13 per 1,000 less, while the death-rate rose from 28·8 to 34·4. Among all classes of prisoners there were 684 deaths, and of these 591 were convicts. Many of the jails were overcrowded during the year, and on the whole the health of the prisoners when admitted was bad, especially those received from famine stricken districts. The diseases which contributed largely to the convict death-rate (34·0) were dysentery and diarrhœa 222 deaths, respiratory diseases 70, pneumonia 67, malarial fever 54, and cholera 46. In the previous year there were 60 deaths from cholera amongst the convicts. The jails principally affected by cholera were those of Daltonganj, Hazaribagh, and Ranchi in the Chota Nagpur division, where the deaths numbered 12, 11, and 5 respectively. Of the convicts who died in jail 23 per cent. were admitted in good health, nearly 32 per cent. in indifferent health, and 45 per cent. in bad health. Out of 47 jails the average death-rate among convicts was exceeded in 23, the highest being 315·1 in Daltonganj against 168·0 in the previous year, Ranchi 115·3 against 40·8, Purulia 94·6 against 25·2, and Barisal 91·5 against 50·7. In five other jails the mortality ranged from 84·6 to 60·4 per 1,000, and in four more over 50 per 1,000. In three jails there were no deaths. The high mortality of the Daltonganj jail was due to the bad state of health of the prisoners admitted, and to cholera, which was the cause of more than half the mortality. The high death-rates at Purulia and Ranchi were due to cholera and dysentery and diarrhœa, diseases usually associated with privation. In

many jails where sanitary improvements were being carried out work was hindered on account of diversion of funds to meet the expense of repairs rendered necessary by the earthquake which occurred on the 12th June 1897.

North-Western Provinces and Oudh.

The effect of scarcity and famine again considerably augmented the criminal population in the North-Western Provinces and Oudh, and during 1897 all the jails except ten were overcrowded. The overcrowding was, however, confined to male convicts, of whom, it is stated, "there were in confinement an average of 4,441 in excess of the number for whom "accommodation is provided." Notwithstanding, the vital statistics do not disclose any marked evil effects therefrom, which "speaks well for the administration and sanitary "condition of the jails."

The admissions into hospital rose from 897 per 1,000 of average strength in 1896 to 1,019, the daily average sick-rate fell from 51 to 50 per 1,000, while the death-rate rose from 28·83 to 35·47. Of the 57 jails in the province, four recorded a death-rate of over 100 per 1,000 and 13 of over 50 per 1,000, the highest being 166·6 in Orai district jail, the result of 37 deaths, 13 of which were due to cholera, 11 to dysentery, and 5 to pneumonia. Several of the jails recorded a very low death-rate, chief among them being Lucknow Central Prison, where there were only 18 deaths, equal to 10·6 per 1,000 on an average strength of 1,696 convicts, a remarkable record since the death-rate of the surrounding district was as high as 51·16 per 1,000. Of the causes of death, cholera in an epidemic form was again absent, only 46 deaths from the disease having been recorded in 1897 in all the jails, against 14 in the previous year. Dysentery was accountable for 307 deaths, being about 25 per cent. of the total number of 1,286. The mortality from diarrhœa was also much greater, 106 deaths having occurred, against 72 in the previous year. Of the total deaths, 1,178 were of convicts, the death-rate being 35·2. According to length of residence in jail, the highest mortality occurred among convicts of over seven years standing, viz., 46·0, followed by those during the first six months of imprisonment, viz., 44·4.

Punjab.

The vital statistics of the Punjab jails are not quite so favourable as those of the previous year, they are nevertheless very satisfactory, being with this exception better than in any year except 1868, when the death-rate was only 12·9. The admissions to hospital per 1,000 of average strength rose from 1,237 to 1,340, the daily sick-rate was the same in both years, 31 per 1,000, but there was a slight increase in the death-rate, from 15·68 to 16·33, which is about half the mortality rate of the province. The only excessive death-rate was returned by the small jail at Bannu, viz., 70·71, the result of 7 deaths. In three jails there were no deaths, and in 10 the mortality was below 12 per 1,000. In several other jails the death-rates were below the provincial jail average. Of the total 208 deaths, all but 14 were of convicts, giving a death-rate of 16·66. The mortality from dysentery and diarrhœa and from respiratory diseases, the chief causes of death, was much higher than in 1896; while the admissions from malarial fevers rose 61·42 per cent., and the deaths from the same cause by 41·67 per cent. "Diseases of this class," the Inspector-General writes, "are the chief direct cause of the sickness, and a great indirect cause of the "mortality among the jail population, so that the discovery of some reliable means of "preventing them would be a solution of the health question as it affects prisoners." There was no case of cholera in any jail. Of the total deaths no less than 50 per cent. occurred among prisoners who had been less than six months in jail, "a fact plainly "indicating the necessity for giving special consideration to the convict on admission "to jail, in respect to all matters affecting his health."

Burma.

The Burma jail statistics show that the admissions into hospital and constantly sick during 1897 were much fewer than in the previous year, the ratios per 1,000 of average strength having declined from 759 and 35 respectively to 596 and 29. The death-rate, however (24·04), was the highest since 1894, and exceeded that of 1896 by nearly 6 per 1,000. The increase in mortality was almost entirely due to the greater prevalence of cholera, for excluding the deaths from this disease the death-rate was 18·91 as compared with 17·63 in 1896. The Inspector General observes "that a distinctly injurious influence "on the jail sick and death returns is produced by the constant deportation of a large "proportion of the healthiest prisoners, and by the return from other provinces of such "Burman prisoners as there lose their health." Of the 323 deaths which occurred during the year, 315 were of convicts, the death-rate being 24·11 against 17·75 in 1896. Cholera was responsible for 69 deaths, distributed over 11 jails, but the numbers of fatal cases were less than five, except in the Moulmein (37 deaths), Myingyan (10), and Minbu (8) jails. The disease appeared in the town of Moulmein on the 8th February, but did not affect the

jail till the 17th March, and between that date and the 8th April the whole 37 deaths occurred. Among other diseases, dysentery contributed 49 deaths, diarrhœa 23, tubercle of the lungs, &c., 39, and malarial fevers 11. The jails of the province continued to enjoy complete immunity from small-pox. Several of the jails recorded a very high death-rate, notably Bhamo (136·99 per 1,000), Kyaukpyu (109·65), Pagan (90·91), Pakokku (84·75), Moulmein (81·74), Minbu (69·57), and Katha (64·10), but these jails are small, except Moulmein and Kyaukpyu, and a few deaths give a high rate. It is reported that all but four of the 31 jails in the province were overcrowded at one time or other during the year.

Central Provinces. The vital statistics of the jails of the Central Provinces for 1897 are again extremely unsatisfactory. The admissions into hospital per 1,000 of average strength rose from 1,108 in 1896 to 1,233, the daily average sick-rate from 40 to 65 per 1,000, and the death-rate from 72·11 to 134·98. These unfavourable results were almost entirely due to the condition of the new admissions, many of them being in a state of extreme emaciation owing to privation through the famine which prevailed in almost every district of the province. Out of the total number of 999 deaths, more than half were caused by dysentery and diarrhœa, chiefly by a highly fatal and malignant form of the former disease. Only one (Damoh) of the nineteen jails recorded a lower mortality as compared with the previous year, and only in three could it be said that the mortality was not excessive. Those of Balaghat, Bilaspur, Mandla, Damoh, Saugor, Seoni, Narsinghpur, Betul, Sambalpur, Chhindwara, and Hoshangabad furnished the highest figures, their ratios ranging from 590·7 to 120·4 per 1,000. Among other diseases, pneumonia and other respiratory diseases caused 69 deaths, fevers 17, and cholera 25. In the previous year there were 15 fatal cases of cholera. All but 53 of the 999 deaths occurred amongst convicts, the death-rate being 138·34, against 73·90 in 1896. Every prison in the province is reported to have been overcrowded, and in some instances the overcrowding was excessive.

Assam. Among the prison population of Assam the rate of admissions to hospital rose from 1,128 per 1,000 in 1896 to 1,255 in 1897, the daily sick-rate remained the same (51), while the death-rate fell from 50·86 to 48·69. The mortality would have been much less but for the earthquake which killed 10 prisoners in the Sylhet jail, and the murder of a prisoner by a fellow convict at Dibrugarh. Excluding these 11 deaths, the death-rate for the whole of the province is reduced to 41·3 per 1,000—"a creditable result," the Government of India observe, "in view of the facts that scarcity was prevalent, that the year was "a particularly unhealthy one, and that many of the prisoners were exposed for a time to "unusual hardships consequent on the demolition of buildings by the earthquake." The improvement in the general health is attributed to a more suitable dietary, better clothing, and to greater strictness in respect of extra-mural labour, for the regulation of which rules have been sanctioned by the Chief Commissioner. In only three of the 22 jails was the average strength above 100, viz., Sylhet, Tezpur, and Gauhati, and these three accounted for 45 out of the total 73 deaths, and their death-rates per 1,000 were respectively 44·03, 48·95, and 67·70. In most of the other jails the average strength was less than 50. As in the previous year many prisoners were admitted into jail in a moribund condition; of the 14 prisoners who died (excluding the 10 caused by the earthquake) from natural causes in Sylhet only 2 were admitted in good health, only 4 out of 11 in Tezpur, and only 2 out of 10 in Gauhati. All but seven of the 73 deaths occurred amongst convicts, being in the ratio of 48·14 per 1,000 against 52·46 in 1896. Cholera was present in six jails and was the cause of death of 11 convicts, as compared with one in the previous year; from dysentery and diarrhœa there were 20 deaths, and from malarial fevers 11.

Madras. In the jails of Madras Presidency the hospital admission rate rose from 583 per 1,000 of average strength in 1896 to 672 in 1897, the daily sick-rate was 30, or 5 per 1,000 more, and the death-rate rose from 19·51 to 47·45, which was the highest since 1879. The emaciated condition of a number of prisoners received from localities affected by famine swelled the sick-rate, and the heavy mortality was mainly due to outbreaks of cholera which occurred in 5 district and 5 central jails. Of the total 490 deaths nearly half (236) were due to cholera, against only two in the previous year. Excluding deaths from this disease the death-rate was equal to 24·6 per 1,000. The Coimbatore and the Rajahmandry central jails suffered most seriously from cholera, the former returning 111 fatal cases out of a total mortality of 146 and the latter 76 out of 125. The highest death-rate was that of Coimbatore jail, 169·13 against 26·15 in 1896, and that of Rajahmandry was 123·08 against 47·09. Apart from cholera, the health of the prisoners at Rajahmandry was not good, owing chiefly to scarcity in the surrounding districts from which prisoners were

sent to the jail. In none of the other jails with a strength of over 200, except Vizagapatam with a death-rate of 58·95, did the mortality reach the Presidency rate ; while in seven jails there were no deaths. Dysentery and diarrhœa and respiratory diseases followed cholera in order of mortality among the prisoners, the death-rate from the former being 8·68 per 1,000, and from the latter 3·14. Of the total 490 deaths convicts contributed 438, representing a ratio of 50·49 per 1,000 of average strength, as compared with 20·33 in 1896.

Bombay.

In spite of plague and famine, there was less sickness among the prison population of the Bombay Presidency during 1897 than in the previous year, but the mortality was higher. The rate of admissions to hospitals per 1,000 of average strength fell from 861 to 807, the daily sick-rate (26) was 6 per 1,000 less, while the death-rate rose from 31·89 to 35·28 per 1,000. Seven out of the 18 jails recorded death-rates above the average, viz., Sind Gang 148·6, Thana jail 118·9, House of Correction 86·3, Nasik jail 66·7, Common Prison 52·5, Shikarpur jail 45·6, and Ratnagiri jail 41·9. All but 38 of the total 331 deaths (including 20 in the lock-ups) occurred among the convicts, their death-rate being 37·8 or 4·4 per 1,000 more than in 1896. The chief causes of mortality were cholera 41 deaths, dysentery and diarrhœa 43, respiratory diseases 67, including 58 from pneumonia, fevers 24, plague 27, and tubercle of the lungs, &c., 24. Of the 41 cholera deaths 37 occurred in the Thana jail and formed more than a third of its mortality. The epidemic broke out in July and lasted 21 days, during which all the 37 deaths occurred. This is the third time within ten years that cholera has appeared in this jail in an epidemic form. In the previous year the outbreak occurred in the same month (July), and lasted 27 days when there were 24 deaths. The surroundings of the jail are reported to be very unfavourable to health, and the drinking water has been repeatedly condemned by the Chemical Analyser to Government. The jail was visited by the Inspector-General and the Sanitary Commissioner in 1896, and as a result of their visits the pipes distributing the water have been renewed and relaid, and arrangements have been made for gradually filling up the moat which partially surrounds the jail. Of the 27 plague deaths, 17 occurred in the House of Correction in Bombay, two in the Common Prison in Bombay, one in Yerrowda jail, and seven in the sub-jail at Surat. Pneumonia, as usual, was very prevalent in the Sind jails, 105 cases, out of a total of 173, having occurred in them, and 40 of the 58 deaths. The Sind Gang was the chief sufferer, with 55 cases and 21 deaths.

Berar.

Although the jails in Berar were overcrowded during 1897 owing to famine and immigration from the Central Provinces, there was less sickness among the prisoners than in the previous year. The rate of admissions into hospital per 1,000 of average strength declined from 594 to 550 ; the daily sick-rate also fell from 18 to 16, while the death-rate rose from 25·13 to 34·77. There was no outbreak of epidemic disease in any of the jails, and the general increase in the mortality was attributed to the enfeebled condition of the prisoners on admission. The deaths numbered 66 against 36 in 1896. The highest mortality was recorded in the Akola jail, where there were 30 deaths giving a death-rate of 46·06, against 14 or 25·72 in 1896, Yeotmal followed with a ratio of 42·93 against 71·92, and next came Basim with 37·21, the result of six deaths. All but four of the 66 deaths occurred amongst convicts, their death-rate being 33·12 per 1,000, as compared with 23·81 in 1896.

V.—VACCINATION.

General results.

During 1896-97 there were 7,144,474 persons successfully vaccinated in the several provinces of India, being a decrease of 138,295 on the number of the previous year. According to age, over $2\frac{3}{4}$ millions (2,804,596) of the total were children under one year of age, and over 3 millions (3,167,955) were children between the ages of one and six years. The proportion of population protected against small-pox by the year's operations ranged from 58·24 in Coorg and 48·08 in Burma to 25·97 in the North-Western Provinces and Oudh. In the vaccination of infants the best results were, as usual, obtained in Berar, the Punjab, and Bombay, where 63·4, 57·5, and 55·5 per cent. respectively of the children born during the year (estimated at 40 per 1,000 of population) were protected against small-pox. In the Central Provinces the percentage was 36·2, and in the remainder it ranged from 34·3 in Burma and 29·2 in the North-Western Provinces and Oudh to 13·1 in Coorg.

Statement showing the total number of persons successfully vaccinated during the year 1897–98 :—

Province.	Population among whom Vaccination was carried on (Census of 1891).	Number of Persons successfully vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Children born during the Year (calculated at 40 per 1,000 of Population) successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	70,832,144	2,244,716	30·25	508,615	1,459,490	17·8
North-Western Provinces and Oudh.	47,146,033	1,224,603	25·97	551,296	482,839	29·2
Punjab	20,724,940	727,575	35·04	476,723	110,457	57·5
Central Provinces	12,944,805	380,815	28·39	187,437	111,880	36·2
Berar	2,897,040	100,762	34·7	73,534	14,241	63·4
Burma	8,146,855	399,032	48·08	111,931	191,543	34·3
Assam	5,634,258	268,858	44·77	58,455	150,264	25·9
Madras Presidency	35,651,577	1,129,238	31·4	331,297	535,399	23·2
Bombay Presidency	22,701,942	658,576	28·89	504,401	107,783	55·5
Coorg	173,055	10,299	58·24	907	4,059	13·1
TOTAL	226,852,649	7,144,474	31·49	2,804,596	3,167,955	30·9

Bengal.

The total number of vaccinations performed in Bengal during 1897–98 was 2,319,536, of which 2,244,716 were successful, against corresponding figures in 1896–97 of 2,293,655 and 2,213,915. This shows an increase of 25,881 vaccinations in 1897–98, which Dr. Dyson says "is satisfactory, considering that the province was just recovering from the effects " of a severe famine in some places and prolonged scarcity in others." The primary operations numbered 2,243,093, of which 98·04 per cent. were successful. According to age, 508,615 of the successful primary vaccinations were of children under one year of age, and 1,459,490 were between one and six years. For the whole province the successful vaccinations were in the proportion of 30·25 per 1,000 of the population. Estimating the births during the year at 40 per 1,000, the percentage of infants successfully vaccinated was only 17·8, a ratio a trifle higher than that of the previous year, but far below that attained in other provinces except Coorg.

Three methods of vaccination are practised in the province—(1) with lymph taken direct from the calf; (2) with calf lymph prepared with lanoline; (3) with human lymph taken by arm to arm transfer. Compared with the previous year's figures there was an increase of over 30,000 in the number of operations performed direct from the calf. Dr. Dyson anticipates that with the progress of time the prejudices of the Hindus against this method of vaccination will gradually disappear. Steps were taken during the year to ascertain the state of public feeling in regard to extending this system of vaccination, and the results showed that while in some districts there was no objection, in others religious

prejudices stood in the way. Having regard to the state of public feeling in connection with plague measures, the Sanitary Commissioner did not consider it advisable at present to make any attempt to extend the system of calf vaccination in places in which the measure was not readily acceptable to the people.

North-Western Provinces and Oudh.

The steady progress in vaccination which has characterized the North-Western Provinces in previous years was arrested in 1897–98. This was due chiefly to the low birth-rate of the year. There were besides other special difficulties: many of the children in the famine-affected districts were in too reduced a condition to undergo the operation, and the time of the officers of the Vaccination Department was much occupied with plague duties. The total number of persons vaccinated in the North-Western Provinces and Oudh fell from 1,528,478 in 1896–97 to 1,385,005 in 1897–98, and the successfully vaccinated from 1,362,169 to 1,224,603. The proportion of persons protected by vaccination is still very small, the ratio for the year being only 25·97 per 1,000, which is the smallest ratio attained in any province in India, and 2·90 per 1,000 below the ratio of the previous year. Primary vaccinations numbered 1,318,912, of which 93·74 per cent. were successful. Of the 1,224,603 successful primary cases, 551,296 were infants and 482,839 were children over one and under six years of age. Estimating the births at 40 per 1,000 of the population, 29·2 per cent. were successfully vaccinated during the year.

Since the 1st February 1896 the areas of operation have been rearranged in two circles for the purposes of control, each being in charge of a Commissioned Medical Officer, acting as Superintendent of Vaccination and Deputy Sanitary Commissioner. In the first circle, the average ratio of success of its 27 districts equalled 25·65 per 1,000 of the population, against a mean for the five previous years of 28·79. In the second circle, the average ratio of its 22 districts was 26·25, against a five years' mean of 23·47. The Vaccination Act is in force in all the municipalities, but in some places it is not worked as efficiently as it should be. The results show a falling off from 38·55, the ratio of successful vaccinations per 1,000 of population in 1896, to 32·51 in 1897.

Punjab.

There was again a considerable falling off in the number of vaccinations in the Punjab as compared with the preceding year. Altogether 845,491 operations were performed in 1897–98, showing a decrease of 56,922 on the figures of 1896–97. Of the primary cases, 94·40 per cent. were successful. The number of successful cases among children under one year of age fell from 485,204 or 58·5 per cent. of the births, calculated at 40 per 1,000 of population, to 476,723 or 57·5 per cent. The provincial ratio of persons successfully vaccinated per 1,000 of the total population was 35·04, against 36·65 in the previous year. Animal lymph was chiefly used, and during the year nearly 83 per cent. of the primary vaccinations were performed with it. In several districts there was a marked diminution in the primary operations, and this was attributed chiefly to the high mortality among children, and partly to failure of lymph and carelessness of the vaccination staff. It is noticed that in the district of Dera Ismail Khan, out of a total of 28,394 deaths no less than 7,619 were infants under one year of age, and 9,964 among children between one and five years of age.

Burma.

Satisfactory progress was made in vaccination work in the province of Burma during 1897–98. The total number of persons vaccinated was 431,550, as compared with 423,848 in the previous year. The least satisfactory returns were those relating to the town of Rangoon, where there was a decrease of 8,600 on the previous year's operations. It is believed, however, that much vaccination work is performed at Rangoon by private practitioners, the results not being recorded. The percentage of success in primary operations continued to improve. Out of 405,928 primary cases, 94·56 per cent. were successful, against a corresponding ratio of 92·38 in the previous year. The number of infants protected was 111,931, equal to about 34 per cent. of the births, estimated at 40 per 1,000 of the population. The Vaccination Act was extended to Thonze, and is now in force in all the municipalities of the province. Proposals were under consideration for amending the law so as to make the Act applicable to small towns administered by Town Committees.

Central Provinces.

Vaccination work in the Central Provinces was considerably hampered during 1897–98 by the famine, and the decreasing birth-rate has naturally been followed by a fall in the number of primary operations. There were 398,699 persons vaccinated during 1897–98, showing a decrease of 15,110 on the number of the previous year. Primary vaccinations fell from 367,821 to 347,230. The percentage of success in primary cases was 96·67,

against 96·20, and the proportion of the total population protected by vaccination was 28·39 per 1,000, as compared with 30·56 in 1896–97. Of the 18 districts in the province, 12 showed a decrease in primary operations, and six an increase. In the protection of infants there was a falling off of 44,688, the number vaccinated under one year of age during the year having decreased from 232,124 to 187,437. Animal lymph supplied the bulk of the vaccination, and worked very successfully, and there is now very little prejudice against its use in the province. Arm-to-arm vaccination is now practised in very few places. With the lymph obtained from calves, 228,829 children were vaccinated during the year, and of these 209,851 were successful.

ssam. The results of vaccination work in Assam for 1897–98 again compare favourably with those for the previous year. There were 283,914 operations performed by all agencies in the province, which is an increase of 9,218 over the figures of 1896–97. There was, however, a falling off in several of the districts, especially in Sibsagar where the operations were fewer by 8,259. The largest increase occurred in Goalpara district (7,616), followed by Nowgong (6,452). Of the total operations 272,713 were primary cases, and of these 99·11 per cent. were reported as successful. The Compulsory Vaccination Act was in force during the year in 11 places, their population being 71,128. The number of infants successfully vaccinated was 58,455, representing only 25·9 per cent. of the births, estimated at 40 per 1,000 of the population.

Iadras. The aggregate number of vaccinations performed in the Madras Presidency during 1897–98 was 1,271,729, being an increase of 24,009 on the operations of the previous year. Of the total, 1,189,146 were primary cases, of which 92·0 per cent. were successful, against 92·5 per cent. in 1896–97. The number of children under one year of age successfully vaccinated rose from 330,819 to 331,297, which represented only 23·2 per cent. of the estimated births, being the same percentage as in the previous year. Vaccination is compulsory in all municipalities, and the number of operations performed by municipal vaccinators rose from 118,655 to 127,724. In the town of Madras the number of operations performed was 33,082, an increase of 6,061 on the previous year, which was chiefly due to the prevalence of small-pox in an epidemic form during the latter part of the year. Of the 21 districts there was an increase of work in 11, the most marked case being that of Ganjam (20,644). The largest decrease was shown in Vizagapatam (15,225), which is the more unsatisfactory as in the previous year Vizagapatam showed the largest increase (22,844). All the operations were performed with animal lymph, and the best results were obtained, as usual, from calf-to-arm vaccination, with a percentage of success of 95·5 against 94·7 in the previous year.

3ombay. Plague and famine greatly interfered with vaccination work in Bombay Presidency. In many parts the people were on the move and not readily got at, and from many of the large towns there was a considerable exodus ; the death-rate was also especially high among children, and there was a low birth-rate. Omitting the statistics of five Native States which are not under the supervision of the Vaccination Department, the out-turn of vaccination work in the Presidency fell from 810,723 operations in 1896–97 to 744,650. This shows the large decrease of 66,073 or 8·87 per cent. The total primary cases fell from 736,511 to 681,839 ; the percentages of success being respectively 93·69 and 91·84. The substitution of animal for human lymph continued to increase in the Presidency. In the City of Bombay vaccination with animal lymph exclusively was carried on throughout the year. Of the 626,170 primary successful cases, nearly 81 per cent. were infants under one year of age. Reckoning the births at 40 per 1,000 of population, 55 per cent. were protected from small-pox. Inoculation was not practised anywhere in the Presidency during the year, and no instances were reported of any disease having been communicated through vaccination.

3erar. Vaccination work continues to advance in Berar. During 1897–98, 125,289 operations were performed, against 120,111 in 1896–97. The increase, however, was entirely under revaccinations as the primary vaccinations fell from 98,594 to 95,048 ; and the percentage of success from 96·8 to 96·4. Of the total number of successful primary operations, 73,534 were performed on infants under one year of age ; estimating the births at 40 per 1,000 of population, 63·4 per cent. were protected from small-pox. The decrease in primary vaccination was attributed to the very high mortality among children in consequence of

the scarcity and distress that prevailed during the year. The Sanitary Commissioner continues his statement showing the efficacy of vaccination in checking small-pox mortality in Berar ; the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of five years 1868-69 to 1872–73, to 33·6, the mean of five years ending 1897–98 ; the mortality from small-pox for the same periods has declined from 2·02 to 0·19 per 1,000. " It may be noted," the Sanitary Commissioner states, " that small-pox " inoculation never prevailed in Berar, and that the disease is quite as virulent amongst " the unvaccinated as it ever was. There is nothing but vaccination to which this great " diminution of small-pox mortality can be attributed. The above figures tend to prove " the axiom that in countries where there is much vaccination and re-vaccination " relatively to the population there is but little small-pox." The Vaccination Act is now in force in all the municipal towns.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1897 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1897	477	55,644	2,778,468	2,834,112
	1896	455	47,109	2,637,501	2,684,610
Calcutta and Howrah	1897	16	28,955	260,806	289,761
	1896	16	25,647	258,794	284,441
North-Western Provinces and Oudh	1897	355	56,936	3,635,480	3,692,416
	1896	350	62,441	3,892,918	3,955,359
Punjab	1897	265	52,381	3,241,543	3,293,924
	1896	267	52,877	3,070,117	3,122,994
Burma	1897	99	34,102	754,458	788,560
	1896	96	30,929	677,560	708,489
Central Provinces	1897	121	14,170	1,512,489	1,526,659
	1896	95	13,527	1,360,602	1,374,129
Assam	1897	101	7,222	602,268	609,490
	1896	101	6,554	562,142	568,696
Coorg	1897	7	1,832	49,970	51,802
	1896	7	1,245	43,902	45,147
Madras	1897	480	63,130	4,247,138	4,310,268
	1896	489	56,625	4,189,762	4,246,387
Bombay	1897	323	47,763	1,766,783	1,814,546
	1896	325	47,090	2,373,637	2,420,727
Berar	1897	47	6,789	318,977	325,766
	1896	46	4,500	340,134	344,634
TOTAL	1897	2,291	368,924	19,168,380	19,537,304
	1896	2,247	348,544	19,407,069	19,755,613

Bengal.

There was a further increase in the number of charitable dispensaries in Bengal in 1897, and in the patients under treatment in them, as compared with the figures of the previous year. The total number of dispensaries at work during 1897 in Bengal, exclusive of the medical institutions at Calcutta, was 477, an increase of 22 on the number of the preceding year. At these there were 2,834,112 patients under treatment, 55,644 being in-door and 2,778,468 out-door patients, against 47,109 and 2,637,501 respectively in the previous year. This shows a total increase of 149,502, which was chiefly due to the famine which prevailed during the year, to the opening of new dispensaries, and to the increasing popularity of the institutions. Compared with other provinces, however, Bengal shows the lowest number of patients per dispensary. "The increase in the number of cases "treated in 1897," it is stated, "would perhaps have been even greater than it was, were "it not for the fact that towards the latter part of the year people were afraid to attend "dispensaries owing to the plague scare which followed the publication of plague "regulations."

There was again a satisfactory increase in the number both of women and children patients. The increase among women amounted to 35,432, the number having risen from

423,238 to 458,670. Of the diseases under treatment at the dispensaries, cholera, dysentery, and diarrhœa, and malarial fevers were responsible, as usual, for the largest number of cases. From malarial fever the cases rose from 506,757 in 1896 to 536,428, equal to nearly 19 per cent. of the total number of patients; next came dysentery and diarrhœa with 166,516 cases, against 137,568 in 1896, and from cholera the number of cases rose from 14,388 to 16,845. Cases of venereal diseases rose from 64,218 to 72,507. The number of deaths among in-door patients rose from 5,487 or 116·4 per 1,000 of total treated in 1896 to 8,172 or 146·8 in 1897. Great attention is paid in these institutions to surgery, and during the year 135,505 operations were performed, against 124,067 in 1896, and of these 216 terminated fatally. The more important operations numbered 3,596, of which 2,718 were extractions of the lens.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1897 and the previous year :—

Name of Institution.	1897.				1896.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	4,672	36,424	41,096	121·0	4,485	35,457	39,942	118·6
Eden Hospital	1,595	3,811	5,406	78·3	1,645	8,432	10,077	86·9
Ezra Hospital	178	1,063	1,241	22·4	205	1,611	1,816	14·6
Shama Churn Law Eye Hospital	554	15,941	16,495	1·8	517	13,206	13,723	—
Presidency General Hospital	2,391	525	2,916	40·5	2,836	356	3,192	53·5
Campbell Hospital	12,041	21,308	33,349	242·3	9,208	21,766	30,974	221 0
Police Hospital	2,577	—	2,577	12·0	2,202	—	2,202	13·1
Mayo Native Hospital	1,978	32,486	34,464	123·8	1,865	32,460	34,325	121·1
Chandney Hospital	243	44,941	45,184	94·6	389	45,357	45,746	59·1
Park Street Dispensary	—	29,046	29,046	—	—	29,266	29,266	—
Chitpore Dispensary	—	22,484	22,484	—	—	22,466	22,496	—
Sukea's Street Dispensary	—	16,750	16,750	—	—	17,480	17,480	—
Dufferin Victoria Hospital	185	5,305	5,490	5·4	296	7,374	7,670	6·7
Bhawanipur Dispensary	—	—	—	—	—	5,278	5,278	—
Southern Suburban Hospital	766	1,888	19,654	201·0	219	7,332	7,551	114·1
Total Calcutta Hospitals and Dispensaries	27,180	248,972	276,152	153·3	23,867	247,871	271,738	132·8
Howrah General Hospital	1,775	11,834	13,609	277·1	1,780	10,923	12,703	236·5
Grand Total	28,955	260,806	289,761	160·9	25,647	258,794	284,441	140·0

The figures for 1897 show an increase of 2,012 in out-door patients, and of 3,308 in in-door patients. The death-rate for all the hospitals was 160·9 per 1,000 of the total in-patients, against 140 in the previous year. The admissions to hospital from cholera rose from 1,007 to 1,200, and 664 cases were fatal. Small-pox was more prevalent in Calcutta than in the previous year, and the cases admitted to hospital rose from 57 to 218. Of these, all but one were treated in the Campbell Hospital,and 56 cases were fatal. Dysentery was more general, and the number of patients rose from 7,778 to 8,415. The number of persons treated for diarrhœa was also larger, viz., 9,836 against 8,020. On the other hand, the number of cases of malarial fever fell from 48,982 to 46,025. Venereal diseases show an increase of 307 patients, the number treated having risen from 14,216 in the previous year to 14,523. There were 25,745 surgical operations performed, and death ensued in 178 cases, against 24,067 and 160 respectively in 1896.

North-Western Provinces and Oudh.

During 1897 there were 355 hospitals and dispensaries at work in the North-Western Provinces and Oudh, or five more than in the previous year. The number of patients who received medical aid was 3,692,416, against 3,955,359 in 1896. There was thus a decrease in 1897 of 262,943, which was principally due to the famine, on account of which a larger number of persons (726,929 as compared with 83,814 in 1896) was treated in famine relief hospitals and poor houses during the year. It is stated that only in two hospitals (the Colvin Hospital at Allahabad, and the Prince of Wales' Hospital at Benares) did the

daily average number of in-door patients exceed to any considerable extent the number of beds available. Of the total number, 53·38 per cent. were men, 22·38 per cent. were women, and 24·24 per cent. were children, the two former showing a small increase on the figures of the previous year, which were 51·48 and 21·42, respectively. The in-door patients numbered 56,936, as compared with 62,441 in 1896, and among them there were 4,514 deaths, giving a death-rate of 79·2 per 1,000, against 3,704 or 59·3 in the previous year. Of the diseases for which the patients were treated 713,032 were suffering from malarial fevers, an increase of 132,280 on the number of 1896 ; cases of cholera fell from 4,190 to 3,585, and cases of diseases of the eye fell from 343,791 to 302,319. From venereal diseases there were 89,012 patients, against 83,765 in the previous year. The number of surgical cases fell from 206,299 to 168,538, of which 144,406 resulted in cure and 443 were fatal. Of the total operations 6,566 were for cataract, of which 81 per cent. were successful, as compared with 8,923 operations and a percentage of success of 84 in 1896.

Punjab. The number of dispensaries at work in the Punjab during 1897 was 265 or two less than in the previous year. Statistics, however, are furnished for 268 institutions, as the returns include those of three famine relief works dispensaries which were in existence for part of the year only. At these, 3,293,924 patients were under treatment, being an increase of 170,930 on the number of 1896. The increase, however, was entirely among out-patients, the in-patients being fewer by 496. Of the diseases for which patients sought relief there were 98 cases of cholera, being a decrease of 772 on 1896. Cases of malarial fever rose from 363,913 to 646,471. Diseases of the eye showed an increase of 2,007 cases, the number treated in 1897 being 382,041, against 380,034. From venereal diseases there were 30,919 cases under treatment, a decrease of 3,495 on the previous year's figures. Among the in-patients there were 2,489 deaths during the year, being in the ratio of 47·5 per 1,000 of the number treated, against a death-rate of 44·2 in 1896. In surgical work operations decreased from 193,370 in 1896 to 173,808. Of these, 164,164 were cured and 296 died. "Various causes," the Inspector-General states, "combined to lessen the "operations. On account of the disturbed state of the frontier, few patients crossed the "border into the neighbouring districts. In many places the pinch of scarcity was sufficient "to prevent people incurring even the small necessary expenditure attendant on a visit to, "and stay in, a hospital. In some places, also, the restrictions and inspections imposed on "travellers on account of plague prevented patients from coming freely to hospitals." There were 4,671 cataract operations, and of these 85·9 per cent. resulted in cure.

Burma. The number of dispensaries existing in Burma at the end of 1897 was 99, or three more than in the previous year. At these, 788,560 patients attended, as compared with 708,489 in 1896. In-door patients rose from 30,929 to 34,102, of whom 24,604 were cured, and 2,613 or 80 per 1,000 died, against 1,921 deaths or 60 per 1,000 in the previous year. The total number of Burmans treated was 465,498, equal to 59 per cent. of the total patients. Malarial fevers, as usual, headed the list of maladies under treatment, the number of cases being 130,180 against 126,085 in the previous year. Cholera was more active than in 1896, and the number of cases rose from 112 to 914, of which the majority were in the lower part of the province. Cases of venereal disease fell from 26,198 in 1896 to 24,758. Surgical work showed an increase of 4,879 operations, the number having risen from 14,737 to 19,616, this large increase being mainly due to the inclusion of hypodermic injections which had been omitted in previous years. The number of patients cured, after being subject to operation, was 18,758, and 101 died.

Central Provinces. The number of hospitals and dispensaries at work in the Central Provinces during 1897 was 121, or 26 more than in the previous year. The total number of patients rose from 1,374,129 to 1,526,659. The increase extended to both in and out door patients, the former having risen from 13,527 to 14,170, and the latter from 1,360,602 to 1,512,489. Among the in-patients there were 1,905 deaths or 134·4 per 1,000 of total treated. The increase in attendance, it is observed, would no doubt have been greater but for the establishment of poor houses and relief works on account of the scarcity, and at which 607,949 patients received medical treatment. As regards the different kinds of diseases, the most remarkable features were the large increase of cases of malarial fevers (47,713), "a fact which clearly shows the unhealthy character of the year," and the diseases which so often accompany want—dysentery, diarrhœa, and ulcers. From venereal diseases there was an increase of 6,899 cases. There were 35,102 surgical operations performed, against 23,176 in 1896. Of these, 33,040 resulted in cure and 60 in death. In the four previous years there had been a considerable increase in operations for cataract, viz., from

479 in 1893 and 949 in 1894 to 1,299 in 1895 and 1,508 in 1896 ; but in 1897 they fell to 964.

Assam.

In the province of Assam the number of dispensaries remained the same as at the close of the previous year, viz., 101, but there was a considerable increase in the number of patients treated, the total for 1897 being 609,490, against 568,696 in 1896. The in-patients numbered 7,222 as compared with 6,551, and of these 3,702 were discharged cured, 606 relieved, 1,117 discharged otherwise, and 1,512 died, the latter representing 209·4 per 1,000 of the total in-patients, against a ratio of 151·5 in 1896. The number of natives of the country treated as in-patients fell from 1,932 in 1896 to 1,772, but the number of foreigners rose from 4,622 to 5,450, mostly *ex*-tea-garden and *ex*-railway coolies, many of the latter being admitted in a moribund condition, which partly accounts for the increased mortality in the dispensaries during the year. Of the total number of persons who received medical aid, malarial fever accounted for 203,816 cases, including 8,459 suffering from kala-azar ; skin diseases other than ulcers 103,132, worms 83,371, dysentery and diarrhœa 35,634, and diseases of the digestive system 26,018. Cholera patients numbered 3,026, against 2,734 in 1896. Of surgical cases there were 13,335, of which 12,688 were cured and 41 were fatal.

Madras.

Exclusive of the hospitals in the Presidency town there were 466 dispensaries working in Madras at the close of 1897, or 9 less than in 1896. The results of the year were again satisfactory. There were 4,092,551 patients under treatment, as compared with 4,042,533 in 1896. There was thus an increase of 50,018. Of the 44,222 in-door patients, 26,716 were returned as having recovered fully under treatment, 9,045 as relieved, and 3,646 as otherwise discharged. The deaths numbered 3,557, representing a ratio of 80·4 per 1,000 of the total in-patients, against 64·4 in the previous year. Ulcers and diseases of the skin, diseases of the eye, diseases of the digestive system, malarial fevers, rheumatic affections, dysentery, and worms were the most common diseases under treatment during the year. Cholera existed in an epidemic form throughout the whole Presidency, and 23,500 cases were under treatment in the various hospitals and dispensaries. From venereal diseases there were 75,310 cases, against 71,654 in 1896. The surgical operations rose from 143,750 in 1896 to 150,766. Of these, 136,137 were cured and 201 terminated fatally.

The number of medical institutions in Madras town remained the same as in 1896, but the number of sick treated increased from 203,854 to 217,717. The in-patients rose from 17,605 to 18,908, and amongst them 9,103 cases were recorded to have been cured or perfectly recovered, 4,494 were relieved, 3,315 discharged otherwise, and 1,144 or 60·5 per 1,000 died, against a rate of mortality in 1896 of 52·4. Of the several diseases for which the patients were treated, malarial fever, diseases of the digestive system, skin, and respiratory system were, as usual, the most common. From cholera there were 119 cases, from dysentery and diarrhœa 8,645, and from venereal diseases 4,445, of which 1,493 were afforded in-door relief. The surgical work performed in 1897 compares favourably with that of the previous year, the operations having increased from 27,903 to 31,794. The results showed that 13,282 cases were cured, 4,311 relieved, and 133 were fatal.

At the Madras Voluntary Venereal Hospital, which is included in the above hospitals in the city, there were 558 female patients treated during 1897, a decrease of 78 on the number of the previous year. The Surgeon General reported that he could not account for the decline.

Bombay.

Excluding the 11 medical institutions in the City of Bombay, there were 312 hospitals and dispensaries working in the Presidency at the end of 1897. At these, 1,742,804 patients were under treatment, of whom 32,585 were in-door and 1,710,219 out-door patients, against 30,857 and 2,288,489 respectively in 1896. There was thus a total decrease of 576,542, which, it is stated, was partly due to the scare caused by the plague and partly to the temporary closure of several dispensaries in the Presidency, the hospital assistants attached to them having been withdrawn for plague duty. Malarial fevers, as usual, constituted by far the largest number of cases (281,641, or 16·2 per cent. of the total treated), still there was a decrease of 104,910 when compared with the figures of the previous year. Next to fever, eye and skin diseases and worms were the most common ailments. Small-pox cases were slightly more numerous, the number having risen from 480 in 1896 to 495 ; cholera cases fell from 5,879 to 5,741 ; dysentery cases were also less numerous ; and patients suffering from venereal affections fell from 30,482 in 1896 to 24,580 in 1897. Of the in-door patients, 22,228 were cured, 1,932 relieved, 2,255 discharged otherwise, and 4,762 died, the ratio of deaths to total treated being 146

per 1,000, more than double the ratio (72 per 1,000) of the preceding year. The total number of patients operated on was 82,352, as compared with 110,994 in 1896, and of these 70,566 were cured and 122 died.

The total number of patients treated at the 11 civil medical institutions working in the town of Bombay during 1897 showed a decrease of 29,639, the figures being 71,742, against 101,381 in the previous year. The in-patients decreased in number from 16,233 to 15,178, and of these 9,280 were cured, 2,048 relieved, 718 otherwise discharged, and 2,079 died, the deaths being in the ratio of 136 per 1,000 of the in-patients, against 106 per 1,000 in 1896. As usual, local injuries, malarial fevers, eye diseases, and skin diseases were responsible for the majority of the cases. Venereal diseases contributed 4,445 cases, against 4,799. Cholera cases rose from 6 to 8, those of dysentery fell from 1,509 to 1,384, and of diarrhœa from 3,454 to 2,795. The total number of patients operated on was 16,783, and of these 14,237 were cured, 146 relieved, 64 discharged otherwise, and 146 died.

Berar. There were 47 medical institutions at work in Berar during 1897, or one more than in the previous year. Of these, eight are hospitals wholly maintained by the State. The total number of patients under treatment was 325,766, against 344,634 in 1896. The decrease was entirely among out-door patients, as the in-patients rose from 4,500 to 6,789. The Inspector General states that the general effect of famine appears to have increased the in-door and decreased the out-door attendance. "Relief centres," he says, "attracted "the labouring classes whose physical condition enabled them to work, thus diminishing "the out-door attendance; whilst the physically unfit and wanderers suffering from chronic "starvation found their way into our hospitals." Of the in-patients, 5,134 were cured and 926 died, which gives a death-rate of 136 per 1,000, as compared with a mortality of 349 or 78 per 1,000 in 1896. Malarial fevers continued to head the list of diseases from which relief was sought, but the cases again fell from 71,822 in 1896 to 71,047; nearly a fourth of the total patients were treated under this head; diseases of the eye and skin came next in order. Cholera cases rose from 3,001 in 1896 to 4,226. There was a decline in surgical work; the total number of patients operated on being 10,538, against 11,412 in 1896. Of these, 10,429 were cured and 24 died.

The Dufferin Hospital for women and children at Amraoti, which was opened on the 15th February 1895, continued to work satisfactorily. The in-door patients during the year numbered 257, and the out-door 5,913, against 128 and 5,806 in the previous year. The operations rose from 161 to 182.

Lunatic Asylums.

Bengal. At the five asylums in Bengal (viz., Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,119 lunatics, including 201 fresh admissions and re-admissions, were under treatment in 1897, being an increase of 17 on the number of the previous year. In the course of the year under notice 64 patients were discharged as cured, and 42 as improved or otherwise, and 90 died. Compared with the figures of 1896, the number discharged was more by 12, while the mortality was about the same. At the end of the year there were 923 persons still under detention, or 5 more than at the close of 1896. The health of the inmates of the asylum was not so good as in the previous year, the average daily number of sick being 129, against 85 in 1896; but the number of admissions into hospital were fewer by 188. The mortality during the year was slightly lower than in the preceding year, the number of deaths having fallen from 90 to 89 and the death-rate from 98·4 to 97·0 per 1,000 of average strength. The results of the working of dairy farms at the asylums were not satisfactory. At Dullunda there was a loss of Rs. 1,134 as compared with a profit of Rs. 636 in the previous year, the reason given being "that a number of dry cows had "to be fed until they were disposed of, and in a year of scarcity the cost of up-keep of such "cows was very high." At Dacca the sale of milk to the public was discontinued, the whole of the produce being issued to the lunatics, the dairy therefore yielded no profit during the year. The dairy farm at Berhampore which was opened in the latter part of 1896 worked throughout the year, but the results were not as satisfactory as was expected.

In the Bhowanipur Asylum, containing European and Eurasian patients only, the inmates during 1897 numbered 55, against 51 in the previous year. Of this number 36 were under detention at the beginning of the year, and 19 were subsequently admitted. In the course of the year 6 patients were discharged cured, 10 were transferred

to the care of friends, and 4 died, leaving 35 under confinement at the close of the year. As regards the health of the patients during the year, there were only 8 admissions to hospital, and 4 deaths. The proportion of deaths to average strength was 107·0 per 1,000, against 150·9 in 1896.

North-Western Provinces and Oudh.

The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the North-Western Provinces and Oudh in 1897 were 1,334, including 238 admissions during the year, against 1,322 in 1896. Before the close of the year 162 patients were discharged, of whom 119 were reported as cured, 43 were made over to friends, and 88 died, leaving 1,084 under treatment at the end of the year. The health of the asylum population was not so good as in the preceding year, and the death-rate per 1,000 of average strength rose from 54·5 to 78·4. Dairy farming was not so successful at Bareilly as in 1896. The profits decreased from Rs. 10,663 to Rs. 6,939, the falling off being attributable to temporary causes connected with high price of fodder and necessity of replenishing the stock. A scheme was initiated during the year for abolishing one of the smaller asylums, probably the Lucknow Asylum, and establishing a large central institution at Agra, under the charge of a whole-time Superintendent who will be able to devote his undivided attention to the asylum and its inmates. The matter was still under consideration at the close of the year.

Punjab.

The total number of lunatics in the Lahore and Delhi lunatic asylums in the Punjab during 1897 was 526, including 144 fresh admissions, against 495 in 1896. At the end of the year the number was reduced to 388 by the discharge of 106 patients (52 as cured, 26 made over to friends, and 28 otherwise discharged) and 32 deaths. In both asylums there was more sickness among the inmates than in the previous year, and the mortality was much higher. The total number of hospital cases was 546. In Lahore the cases rose from 367 in 1896 to 498, and the deaths from 18 or 76·6 per 1,000 of daily average strength to 21 or 81·5. In the Delhi Asylum the deaths numbered 11 or 85·8 per 1,000, against 4 or 33·9 in 1896. No special diseases were present in any unusual degree, and there was a satisfactory falling off in the number of pneumonia cases at Lahore, which was attributed largely to the increased material comforts of the inmates. In the Delhi Asylum, on the other hand, pneumonia prevailed somewhat.

Burma.

The Rangoon Asylum is the only one in the province of Burma. Until the year 1894 a number of lunatics were, for want of accommodation, confined and treated in the Rangoon central jail. The asylum has since been twice extended, and there is now accommodation for 414 insanes. During 1897 there were 448 patients in the Rangoon Asylum, including 115 fresh admissions, and the total was reduced at the close of the year to 342 by the discharge of 70 patients for different causes, and the death of 36. Although the daily average sick was much lower than in 1896, the admissions to hospital rose from 104 to 155. No epidemic disease occurred among the patients, but the deaths rose from 30 or 90·3 per 1·000 of average strength to 36 or 108·0. Four of the deaths occurred within the first month, and 3 more within the second month of residence in the asylum, all of whom were civil lunatics. Of the 448 insanes 202 were criminal lunatics, and among them were 10 deaths as compared with 26 among civil lunatics, the high mortality among the latter being attributed to their general bad state of health on admission.

Central Provinces.

In the two asylums of the Central Provinces (Nagpur and Jubbulpore), there were 382 lunatics under treatment during 1897, the same number as in 1896. In the course of the year 44 patients were discharged as cured or otherwise, and 27 died, leaving 311 still under treatment at the commencement of 1898. Both asylums were less healthy than in 1896. The admissions to hospital at Nagpur rose from 50 to 59, but at Jubbulpore they fell from 109 to 108. The chief cause of sickness was, as usual, ague, from which there were 21 admissions at Nagpur, and 35 at Jubbulpore. At both asylums the mortality was higher as compared with the previous year. Of the total 27 deaths, Nagpur recorded 14, being in the ratio of 83·7 per 1,000 of average strength, against 7 or 39·4 in 1896. At Jubbulpore there were 13 deaths, being in the ratio of 86·2 per 1,000, against 11 or 71·3 in 1896. A dairy farm was started in 1895 at Nagpur Asylum, and it has continued to give excellent results both financially and in regard to the health of the inmates.

Assam.

There is only one lunatic asylum in the province of Assam. This is situated in Tezpur, and the building is reported to be at present large enough for all demands on it. The total number of lunatics under treatment in the asylum during 1897 was 153, the same number as in the previous year. Of these, 27 were fresh admissions. At the close of the year the patients in the asylum were reduced to 118, 24 of the total number having

been discharged, 10 died, and one escaped. Although the year was an unhealthy one in the district, there was less sickness in the asylum, but the mortality was higher. Among the 153 inmates 92 were admitted to hospital, as compared with 130 in 1896. The number of deaths was greater by three than in 1896, and the death-rate rose from 60·1 per 1,000 of average strength to 81·6. Three of the deaths were from phthisis, and two from dysentery.

Madras. At the commencement of 1897 there were 584 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 158 fresh cases were admitted, bringing the total population up to 742, or 22 less than the number in the preceding year. In the course of 1897 there were 103 cases of discharge, and of these 61 were cured. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. On the whole there was less sickness among the patients than in the previous year ; the daily average sick fell from 87 to 78, while the deaths rose from 46 or 77·7 per 1,000 of average daily strength to 59 or 100·5. No epidemics occurred in the Madras and Vizagapatam Asylums, but cholera appeared in the Calicut Asylum, and the necessary steps for segregating the patients and preventing the spread of the disease were taken. Of the total 59 deaths the Madras Asylum contributed 37, giving a death-rate of 87·8 per 1,000 on an average strength of 421, against a ratio of 89·6 in 1896. The death-rates of the other two asylums, Vizagapatam and Calicut, were 14·0 and 223·4 per 1,000 respectively, against 14·9 and 69·2 in the previous year. In the Calicut Asylum there were 21 deaths, and of these 8 were due to cholera.

Bombay. The total population of the six lunatic asylums of the Bombay Presidency (Colaba, Ratnagiri, Poona, Dharwar, Ahmedabad, and Sir Cowasji Jehangir, Hyderabad) was 1,029, including 293 fresh admissions, chiefly mendicants and beggars, against 1,006 in 1896. In the course of the year 187 patients were discharged, 81 of them as cured, and 81 died, leaving 761 under treatment at the close of the year. There was slightly more sickness in the asylums than in 1896, the daily average sick having increased from 47 to 49, the deaths also rose from 78 to 81, but owing to the increase in the daily average strength the death-rate fell from 107·8 to 105·9. Of the 81 deaths, 22 were due to dysentery, 12 to phthisis, and 7 to Bright's disease. The death-rate was higher in all the asylums, excepting Colaba and Ahmedabad. The Colaba Asylum recorded the highest mortality, viz., 168·4, but this was 17·2 per 1,000 lower than the ratio of 1896.

Medical Schools.

Bengal. The number of medical schools open in Bengal during 1897–98 was 9. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided—two being schools of homœopathy, and two of allopathy. The college is affiliated to the University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the four unaided schools follow their own standards for private practice. The total number of pupils attending the various medical schools in the province was 1,815, as compared with 1,950 in the previous year.

The number of students at the Calcutta Medical College at the beginning of the session in 1897–98 was 583 (including 16 women), against 588 in the preceding year. As regards the examinations, 194 candidates were successful out of a total of 440 (including 1 woman), the successes being at the rate of 44 per cent., as compared with 55 per cent. in 1896–97. Of the 194 successful candidates, 61 passed the Preliminary Scientific L.M.S. examination, 53 passed the first, and 33 the second L.M.S. examinations ; 18 passed the Preliminary Scientific M.B. examination ; five passed the first and three the second M.B. examinations ; 15 native dais passed in midwifery from the Eden Hospital, and received certificates of qualification, and 14 pupil nurses also passed as midwives.

The Campbell Medical School had 301 pupils (including 34 women) on its rolls during the session. Of this number 56 males and 9 women passed the final examination for the diploma.

At the Dacca Medical School there were 169 pupils on the rolls (including 10 women). Thirty-eight students (including one woman) passed the final examination.

The Temple Medical School, Patna, had 133 students (including 4 women) on its rolls. At the final examination 28 candidates passed, including two women.

At the Cuttack Medical School there were altogether 114 pupils (including five women). At the final examination 31 candidates (including two women) passed.

North-Western Provinces and Oudh.

The number of pupils of the various classes of the Agra Medical School who attended the examination at the close of the year 1897–98 was 259 (including 59 women), as compared with 252 at the end of the preceding year. The results of the final examination of male students show that 43 out of 52 candidates passed. All the 6 military students in this class passed, and 34 of the 41 civil students passed. Of the students in Class II., comprising second-year military and third-year civil, private, and Rajputana pupils, 11 out of 15 military pupils and 22 out of 27 civil pupils passed the first half professional examination. All classes of pupils are reported to have done better in the year under notice than in the previous year, their average marks being higher all round.

As regards women students, the year's working shows that 10 out of 15 in Class I. passed the final examination, and that 7 out of 17 in Class II. passed the first half professional examination.

Punjab.

The total number of students at the Lahore Medical College and School during 1897–98 was 415, or 50 less than in the previous year. Of these, 210 were in the College Class, and 205 were in the Medical School. There was a decrease of 37 in the number of college students, which was due to the introduction of a higher standard of attainment as a condition of admission. The results of the year's examinations were less favourable than in the previous session. Six students appeared at the first examination for the M.B. degree, and two passed, and 60 at the first L.M.S. examination, of whom only 20 or 33 per cent. passed. In the second L.M.S. examination 13 passed out of 34, and in the second M.B. examination three candidates appeared and all passed.

In 1894 a medical school for women, called the North India Medical School for Christian Women, was opened at Ludhiana. The object of the institution is "to provide a thorough "medical training, under fully qualified Christian women, for those Christian women and "girls who wish to prepare themselves for medical mission work." At the end of 1897 there were 20 students on the rolls, or 4 less than in the previous year, and they were reported to be making satisfactory progress.

Madras

The number of students at the Madras Medical College (including the School Department) during 1897–98 was 478, including 33 women students. In the Hospital Assistant Department, consisting of 206 pupils, 57 appeared for the final examination, of whom 39 passed. The results of the several University examinations were again satisfactory, 32 having passed out of 63 candidates entered, against 42 out of 65 in 1896–97. In the College Department there were, as in the previous year, 41 (including one woman) regular students reading for the M.B. and C.M. degree, 26 (including one woman) reading for the L.M.S. degree, and 16 casual students.

The Board Medical School at Nellore having been closed, the only other medical school at work during the year was the Prince of Wales' Medical School, Tanjore. At this there were 47 pupils on the rolls, all of whom were being prepared for the Hospital Assistants' Certificate. Six candidates appeared for the final examination and all passed.

Bombay.

The attendance at the Grant Medical College, Bombay, rose from 279 in 1896–97 to 320 (including 26 women) in 1897–98. For the first University examination in medicine 120 candidates presented themselves, of whom 41 qualified; and for the second examination in medicine 37 passed out of 71 candidates. For the final examination for the degree of L.M.S there were 36 candidates, and of these only 11 passed, all in the second class. Out of a total of 41 military medical pupils 10 passed their final examination. A number of the students were deputed to assist in the examination of persons leaving Bombay by sea, and also in house to house visitations on account of the plague, and the Principal testified to their behaviour and courage in the execution of these duties.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The number of students was 214, and of these 52 passed the final examinations.

VII.—SANITATION.

Bengal.

In Calcutta further progress was made in the improvement of bustees, or clusters of Native huts. The supply of filtered water was slightly less than in 1896, and the average daily consumption was equal to 38·10 gallons per head of population for the town proper, and 11·26 gallons for the suburban area. In the course of the year the distribution pipes were extended about 2½ miles, bringing the total length up to nearly 315 miles, and the total number of premises connected had reached 27,775. The supply of unfiltered water was rather higher, and the daily consumption per head of population was equal to 12·51 gallons, as compared with 12·47 gallons in 1896. A scheme for the extension of the unfiltered water supply was carried out during the year and completed in March 1898, the result being an extension of the water main by over 15½ miles, bringing the total length of pipe up to 96½ miles. A second project for extending the unfiltered water supply to the suburbs was also being carried out. At the close of the year (1897–98) the total length of sewers was a little over 209¼ miles, and the number of premises connected with them was 29,848, of which 260 connections were made during the year. Satisfactory progress was made with the new drainage project for the municipality. Further improvement was made during the year in the conservancy of the port of Calcutta.

The total amount spent on sanitary works in urban and rural areas during the year was Rx. 209,934, a decrease of Rx. 33,757 on the sum expended in the previous year. Of the total Rx. 53,160 were spent in towns and Rx. 156,774 in rural areas. In addition, a further sum of Rx. 116,747 was contributed by private individuals for the same purpose, the latter item showing a satisfactory increase. The most important works were the completion of the Bhagalpur water supply at a cost of Rx. 27,096, commencement of work on the Berhampore water supply, and the extension of that of Cossipur-Chitpur. A drainage scheme for the latter municipality and for that of Maniktola were under consideration, and the Krishnagar scheme has been adopted. The Howrah scheme, which was prepared by the engineer of the Calcutta Corporation, was found too expensive, and has fallen through.

The Sanitary Board held meetings in the course of the year, when, among other important matters, they discussed the Howrah drainage scheme and the drainage of the suburbs of Calcutta. Under the orders of the Government the Board prepared a water-supply scheme for the Garden Reach Municipality, estimated to cost Rx. 5,000, and another for Darjeeling, to cost Rx. 11,000. For the Patna Municipality a road drainage scheme was prepared, estimated to cost Rx. 5,600. Experimental borings for water were carried out with great success at Patna, and it is in contemplation to substitute the river Sone for the Ganges as the source of the town's water supply.

North-Western Provinces and Oudh.

In the North-Western Provinces and Oudh the municipalities expended over 41 per cent. of their income on water supply, drainage, and conservancy. In most of the municipalities possessing waterworks, house connections were extended, and the quality of the water was good. At Allahabad work was commenced in extending the filtered water-supply to Daraganj and in the completion of the sewerage of the City of Benares. "Both works," the Army Sanitary Commission observe, "are of the utmost "importance in their bearing on the health conditions of the two cities subjected to special "danger from importation into them of disease by pilgrims from all parts of India." Reservoirs were begun at Naini Tal, for which town a comprehensive scheme is in course of preparation. At Benares and Mussoorie drainage projects were in progress. The chief work of the year lay rather in village improvements in connection with famine relief, and in the measures taken for the prevention of plague. The Sanitary Commissioner reports that the principal towns of the provinces have never been, during the last 20 years, in so satisfactory a sanitary condition as they are at present. The Village Sanitation Act, which had been found useful in certain districts to which it had been tentatively extended, was in 1896 brought into force throughout the provinces.

Two meetings of the Sanitary Board were held during the year under report. From lists forwarded to the Government by the Sanitary Board it appears that, between 1889 and 1896, 255 drainage projects have been completed by the Irrigation Department at a cost of Rx. 117,413, while on the 1st April 1896, 50 works were in progress at an estimated

cost of Rx. 43,500. The programme for 1897 and the two following years comprises the construction of 104 drainage works at a cost of Rx. 54,681, these being arranged by districts in order of urgency.

Punjab.

In the Punjab the municipal towns spent 23 per cent. of their income on sanitary work. During the year the water-supply scheme of Pind Dadan Khan, in the Jhelum district, was completed, as was also the water supply for the cavalry lines at Kohat. The water-supply projects of Bhiwani, Peshawar, and Edwardesabad were in progress, and those of Amritsar, Ludhiana, and Mooltan, the extension of the Delhi supply, and the supply of the Mian Mir cantonments from Lahore, were under preparation. In Delhi a portion of the drainage scheme has been completed, and the remainder is under preparation. Drainage projects for Mooltan, Rawalpindi, Hazro, and other towns were in progress, while Rx. 7,800 were spent on the works at Lahore, and Rx. 1,060 on drains at Peshawar. Besides these, several works of public utility were constructed by private individuals at their own expense to serve sanitary purposes.

The Sanitary Board met once during the year, when they considered, among other matters, the prevalence of fever in the province, specially in swampy and water-logged areas, and the remedies that might be applied ; and suggestions concerning the unhealthiness of certain villages in the Umballa district.

Burma.

The towns and districts of Burma spent over 33 per cent. of their income on sanitary improvements. No important work was undertaken during the year, but municipal committees are reported to have devoted a considerable share of their attention to the subject, and expenditure was incurred on the preliminary experiments and surveys which are necessary before a mature scheme can be elaborated. A Sanitary Engineer has been appointed for the province, and was employed during this year in examining a scheme for supplying water to the town of Moulmein. In Rangoon experiments carried out by private individuals, with a view to testing the efficiency of tube wells as a permanent source of water supply, appear to have met with success, and it is in contemplation to adopt this system. Schemes for improving the water supply were being considered by the municipal committees of Bassein and Prome. The village sanitary rules which were issued in 1895 were working well, and in many cases resulted in improvements in drainage and conservancy.

The work of the Sanitary Board was again restricted to the provision of suitable sanitary maps of the larger towns. Complete maps have now been made for 15 towns and others were in preparation.

Central Provinces.

The municipalities in the Central Provinces expended 18 per cent. of their income on conservancy, drainage, and waterworks. The most important works undertaken or in progress were schemes for supplying water to certain municipalities. The Jubbulpore waterworks were further extended during the year, and were nearing completion. The Khandwa works were practically completed, and progress was being made with those at Wardha ; but the Harda scheme has been temporarily postponed for want of funds. The system of village sanitary inspection books has been introduced in several districts, but little progress was made in filling them in with the information required, owing to the heavy duties falling on civil surgeons in connection with the famine and plague. The Village Sanitation Act of 1889 was extended to one additional village during the year.

The Sanitary Board met in each of the four divisions during the year, when proposals and estimates for schemes of sanitary improvement in the various districts were considered.

Assam.

Excluding the towns of Hailakandi, Sunamganj, Karimganj, and Maulvibazar, which have no separate incomes of their own, the municipalities, stations, unions, and towns in Assam spent 44 per cent. of their income on sanitation. No extensive sanitary work was undertaken during the year, but the waterworks at Gauhati and Shillong, which suffered from the earthquake, were under repair. The sanitary improvements effected in rural tracts were comparatively unimportant, though some progress was made in the direction of providing a purer water supply by the construction of masonry wells and the excavation of tanks at some of the larger villages.

No meeting of the Sanitary Board was held during the year ; but the opinions of the members on important sanitary matters under discussion were obtained unofficially.

Madras.

In Madras Presidency the municipal councils allotted 63·6 per cent., and the district boards 8·4 per cent., of their income for sanitary purposes. During the year the water-supply works at Conjeeveram and Kurnool were completed, the latter being designed to

supply 15 gallons per head *per diem* to a population of 30,000 ; while those of Coconada, Tirupati, and Vizagapatam were in progress. Village sanitary inspection report books were in use in all unions in 19 out of the 22 districts of the Presidency at the end of the year, the exceptions being Malabar, Anantapur, and Tanjore.

The Sanitary Board during 1897 scrutinised plans and estimates for 185 sanitary projects, aggregating in value nearly 12 lakhs of rupees, of which 54 were for municipalities and 131 for local fund boards.

The Sanitary Engineering Department completed surveys for water supply or drainage for two municipalities, and one scheme was still under consideration. Four schemes, costing Rx. 167,700, were submitted to the Sanitary Board, the most important being the water-supply scheme for Negapatam, estimated to cost 10 lakhs, and a drainage scheme for Cuddapah, to cost $5\frac{1}{2}$ lakhs. The latter, as well as a water-supply scheme for Tuticorin and a drainage project for Ootacamund, was under consideration of Government at the end of the year. Preliminary reports were also made regarding the water supplies of Ellore, Conjeeveram, Trichinopoly, and Cuddapah (extension) ; the estimate for the Coconada works was revised, and other minor estimates made. Eleven out of the 58 municipalities in the Presidency now possess public water-supply and drainage works, and of these nine were executed by the Sanitary Engineering Department during the seven years it has existed.

In improving the sanitation of Madras City several useful improvements were being carried out. The water supply was extended, and a project estimated to cost nearly 16 lakhs was submitted to Government. The long-contemplated scheme for the drainage of the city has been taken in hand, the Commissioners having now almost finished the drainage of Mylapur. But it will be several years before the drainage scheme is completed, and until this is done, and the proposed improvements in the water supply are effected, Madras cannot be expected to become a healthy town.

Bombay. In Bombay Presidency the municipalities, exclusive of Bombay City, allotted 57·21 per cent., and the district boards 20·84 per cent. of their income for sanitary purposes. During the year improvements to the waterworks at Hyderabad, Surat, Ahmednagar, and Jacobabad were executed ; while those at Yeola, Sukkur, and Karachi were practically completed. At Ahmedabad one-fifth part of the sewerage scheme drawn up by Mr. Baldwin Latham was completed, and has proved so satisfactory that it was intended to extend it to the rest of the city. There was not, however, satisfactory progress in sanitary works during the year, owing to the demands on municipal funds caused by the plague. The Bombay Village Sanitation Act of 1889, under a modified form, has been brought into force in all the districts except Kanara and Upper Sind Frontier.

The Sanitary Board gave advice concerning a large number of projects, including the waterworks of Malegaon in Nasik district, and Sholapur, the sewage farm at Hyderabad, and other sanitary schemes which had been submitted to them. The water supply and drainage of Poona and Nasik are still unsatisfactory.

In Bombay City the Shone system of sewerage at Colaba worked satisfactorily during the year, and the sewerage of Mazagon on the same system has been started. In other divisions drainage and sewerage works were in progress, while several new works were commenced. The water supply of the city from Tansa, Vehar, and Tulsi lakes continued to be adequate ; structural and other improvements in the reservoirs were being carried out.

Berar. The municipalities of Berar spent 71 per cent. and the district boards about 16 per cent. of their income on sanitary improvement. No new works of any great importance were undertaken during the year, but Rx. 2,500 were spent on repairs to the Khamgaon tank, and a drainage scheme for Amraoti was under consideration ; while in the latter town specially active measures were also taken to guard against plague.

The District Sanitary Boards met once at each of the six headquarter stations. The Medical Department of the province was much occupied in supervising famine relief camps, and the sanitary survey did not make much progress during the year. The total of towns and villages surveyed up to date is 918. The Sanitary Commissioner states that sanitary progress has been steady, though slow, and that the people have generally appreciated improved water supply, drainage, or conservancy.

W. T. Ronson.

India Office,
October, 1899.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1897.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1897.

(*Surgeon-General Robert Harvey, M.D., C.B.*)

European Troops.

Sickness and mortality in 1897.

THE health of the European army of India was much worse in 1897 than in the preceding year. This was due partly to the increase of malaria consequent on the prolonged drought being followed by an abundant monsoon, and partly to exposure and injury on field service.

YEAR.	Strength.	RATIO PER 1,000 OF STRENGTH.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	TOTAL LOSS.
1886–95	677,877	1,457	83	15·16	24	39
1896	70,484	1,387	94	14·84	28	43
1897	68,395	1,557	101	22·93	33	56

The chief causes of admission were venereal diseases and ague. Among the diseases with increased admission rates were cholera, fevers, dysentery, and diarrhœa. On the other hand, the admission rates from influenza, small-pox, respiratory diseases, hepatitic diseases, and venereal diseases, were lessened. Venereal diseases caused 31 per cent. of the total sickness, and ague 25 per cent.

The chief causes of death were enteric fever, dysentery, abscess of the liver, and cholera. Among the diseases with increased mortality were dysentery, diarrhœa, cholera, enteric and other fevers, heatstroke, hepatic abscess. On the other hand, the mortality from small-pox and diseases of the respiratory organs was lessened. Enteric fever caused over 39 per cent. of the total deaths, dysentery 11 per cent., hepatic abscess nearly 6 per cent., and cholera over 5 per cent.

The chief causes of invaliding were, in order, syphilis and gonorrhœa, debility, malarial fevers, and tubercle of the lungs.

In the following Table the ratios of the four commands are placed side by side for comparison. Bengal had the highest mortality from cholera, heatstroke, and hepatic abscess; the Punjab the highest from small-pox, enteric fever, ague, remittent fever, tubercle of the lungs, pneumonia, other respiratory diseases, and dysentery; Madras the lowest from enteric fever and pneumonia; and Bombay the lowest from ague, heatstroke,

and dysentery. The percentage of enteric fever was highest in the Punjab ; of dysentery in Madras ; of hepatic abscess and cholera in Bengal. The total death-rate of Madras, which was the lowest, only reached 56 per cent. of the height of that of Bengal, which was the highest. Bengal had the highest constantly sick, admission, and death-rates, and all the commands were less healthy than in the previous year.

Ratios of Commands.

	Ratio per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.
I.—Strength	20,113	17,190	12,369	14,859	68,395
II.—Constantly Sick-rate	112·9	93·4	104·5	92·3	101·4
III.—Admission-rate of the Year :					
Influenza	9·2	1·0	5·5	·1	4·0
Cholera...	4·6	·2	·6	·7	1·7
Small-pox	·5	·2	·3	·3	·4
Enteric fever	39·1	42·1	19·2	20·4	32·4
Intermittent fever	356·1	442·5	121·5	406·4	394·7
Remittent fever	13·6	25·5	24·7	11·4	25·4
Simple continued fever	48·7	24·9	69·0	32·8	42·9
Tubercle of the lungs	3·5	3·7	6·5	4·6	4·2
Pneumonia	3·2	4·9	2·3	1·9	3·4
Other respiratory diseases	20·1	22·5	23·4	22·2	22·7
Dysentery	38·1	32·1	44·9	22·9	45·7
Diarrhœa	29·9	30·7	9·1	28·3	33·2
Hepatic abscess	3·0	1·4	2·0	2·4	2·1
„ congestion and inflammation	21·3	11·3	25·7	15·3	17·5
Venereal diseases	600·0	404·2	541·7	474·7	485·7
All Causes	1,619·4	1,460·2	1,353·9	1,508·0	1,556·9
IV.—Death-rate of the Year :					
Cholera...	3·28	·12	·32	·54	1·17
Small-pox	·05	·17	—	—	·06
Enteric fever	10·39	11·05	4·93	6·46	9·01
Intermittent fever	·30	·47	·16	·07	·41
Remittent fever	·10	·70	·49	·47	·60
Simple continued fever	—	—	—	·07	·01
Heatstroke	1·19	·70	·57	·54	·91
Circulatory diseases	·65	·70	·49	·47	·56
Tubercle of the lungs	·35	·76	·73	·54	·56
Pneumonia	·45	1·11	·16	·20	·60
Other respiratory diseases	·10	·12	—	·07	·10
Dysentery	1·64	1·75	1·13	·34	2·53
Diarrhœa	—	·12	—	·07	·23
Hepatic abscess	2·09	·76	1·13	1·14	1·29
All Causes	23·32	21·52	13·10	14·33	22·93

The following table gives vital statistics of the European troops in Burma as a whole :—

Period.	Strength.	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths from		
				Cholera.	Other causes.	Total.
1890	4,712	1,743	·102	—	20·80	20·80
1891	4,623	1,589	92	2·38	17·74	20·12
1892	4,316	1,491	91	—	14·83	14·83
1893	3,928	1,461	96	·25	12·73	12·98
1894	3,940	1,465	93	·25	9·39	9·64
1895	4,045	1,410	96	·99	8·41	9·39
1896	4,174	1,514	109	·48	6·71	7·19
1897	4,060	1,467	107	—	10·84	10·84

Burma in 1897 was distinguished by the prevalence of influenza, remittent fever, simple continued fever, and venereal diseases.

Of the forces which took the field in 1897, the Tochi Force, which was for the most part condemned to inactivity in the trying Tochi Valley, was the most unhealthy, suffering severely from dysentery, diarrhœa, enteric fever, remittent fever, and ague. Next came the Tirah Force, whose statistics were unfavourably influenced by severe fighting; followed, in order, by the Malakand, Kohat-Kurram, and Mohmund Forces.

The following table shows that, judging by the constantly sick-rate, Burma Inland and the Gangetic Plain were the most unhealthy groups for the decennium, and the Hills and the Deccan the most healthy. It also shows that the 1897 constantly sick-rate of every group, except the Western Coast, was higher than its corresponding decennial ratio, and that the rise was greatest in the case of Central India, the Burma Coast, the Hills, and the Deccan. As compared with the decennial ratios, there was decrease of cholera mortality in eight groups, and increase of enteric fever mortality in nine :—

		Ratio per 1,000 of Strength.												
		I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
		Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
1886-95	Constantly sick ...	89·0	99·4	92·9	96·0	88·9	83·9	88·0	79·1	81·7	82·2	70·9	88·0	82·6
	Death—Cholera ...	·21	1·71	·78	4·31	1·14	1·13	1·65	·74	—	·30	·61	·78	1·33
	Death—Enteric fever	3·02	2·47	3·13	5·98	7·03	5·30	7·00	4·69	2·14	2·79	5·56	4·98	5·28
1896	Constantly sick ...	115·7	110·9	79·6	100·7	92·3	95·1	120·1	89·7	78·2	78·4	89·6	88·5	93·8
	Death—Cholera ...	·76	·37	1·22	1·07	·21	—	2·64	1·58	·64	1·12	—	—	·89
	Death—Enteric fever	1·53	·37	4·07	11·61	5·21	5·79	8·39	6·01	10·28	5·34	8·20	3·62	6·31
1897	Constantly sick ...	117·2	105·8	95·4	107·9	99·8	103·8	127·7	100·5	76·9	93·9	98·4	88·4	101·4
	Death—Cholera ...	—	—	·88	6·59	·15	·20	2·60	·56	—	—	—	—	1·17
	Death—Enteric fever	6·66	1·12	·44	10·24	9·77	12·64	20·16	6·43	3·40	5·67	8·36	3·17	9·01

In the following table the vital statistics of the groups for 1897 will be found placed side by side to facilitate comparison. Central India had the highest constantly sick, admission, and death rates; the Western Coast the lowest constantly sick-rate; the Hill Convalescent Depôts the lowest admission-rate; and the Burma Inland group the lowest death-rate. Burma Coast had the highest admission-rate from influenza and venereal diseases; Burma Inland the highest from remittent fever and simple continued

fever; Bengal-Orissa the highest from respiratory diseases other than pneumonia, dysentery, and hepatic abscess; Gangetic Plain the highest from cholera and small-pox; Indus Valley the highest from ague and pneumonia, the Convalescent Depôts being equal in pneumonia; Central India the highest from enteric fever and diarrhœa; the Deccan the highest from tubercle of the lungs; Southern India the highest from congestion of the liver; and the Hills the highest from rheumatic fever.

Ratios of Geographical Groups.

	Ratios per 1,000 of the Average Strength.												
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XIIa.	XIIb.	
	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
I.—Strength	1,202	2,678	2,269	6,833	13,508	4,983	6,150	8,865	1,471	3,177	7,058	3,156	68,395
II.—Constantly Sick-rate of the Year.	117·2	105·8	95·4	107·9	99·8	103·8	127·7	100·5	76·9	93·9	98·4	88·4	101·4
III.—Admission-rate of the Year:													
Influenza	51·6	·4	—	22·2	·2	—	·2	·5	—	·3	4·7	4·8	4·0
Cholera	—	—	·9	10·5	·3	·2	2·9	1·1	—	·3	—	—	1·7
Small-pox	—	·7	·4	1·0	·4	—	·5	·2	—	—	—	—	·4
Enteric fever	20·8	1·1	11·0	36·9	33·5	22·3	63·7	24·3	10·2	26·8	49·7	14·9	32·4
Intermittent fever	47·4	132·6	383·9	246·7	422·0	761·8	584·2	333·3	182·2	139·4	128·1	158·7	394·7
Remittent fever	5·0	88·5	24·7	13·9	12·7	36·5	14·6	7·2	6·1	6 3	16·7	5·4	25·4
Simple continued fever ..	84·0	105·3	35·7	81·1	29·4	28·3	44·9	42·3	35·4	72·4	8·5	3·2	42·9
Rheumatic fever	—	2·2	·4	·7	1·6	1·0	·8	2·0	·7	·6	7·5	4·8	2·1
Tubercle of the lungs ..	1·7	4·5	4·8	3·2	2 9	3·6	2·8	5·9	3·4	3·1	5·1	3·8	4·2
Pneumonia	—	2·6	2·6	2·5	3·8	6·0	2·0	1·7	—	2·8	3·3	6·0	3·4
Other respiratory diseases	20·0	29·9	30·0	14·0	24·8	21·1	26·0	21·5	27·9	19·8	22·5	14·9	22·7
Dysentery	49·1	27·6	61 3	40·5	27·7	41·5	34·1	32·0	13·6	53·5	21·7	22·8	45·7
Diarrhœa	5·8	20·5	28·6	33·1	24·7	33·3	38·2	22·1	17·7	4·1	27·2	22·8	33·2
Hepatic abscess	2·5	·4	5·7	2·9	1·3	1·6	3·1	2·0	·7	3·5	1·6	4·4	2·1
„ congestion and inflammation.	30·0	16·8	27·8	21·5	13·5	9·2	22·3	18·4	13·6	39·0	13·9	13·6	17·5
Venereal diseases	643·9	558·3	413·0	616·9	491·0	345·8	595·8	557·6	356·9	517·5	511·9	389·4	485·7
All Causes	1,474·2	1,512·3	1,501·1	1,513·4	1,504·1	1,781·7	1,959·3	1,457·4	1,163·6	1,392·8	1,245·4	1,138·1	1,556·9
IV.—Death-rate of the Year:													
Cholera	—	—	·88	6·59	·15	·20	2·60	·56	—	—	—	—	1·17
Small-pox	—	—	·44	—	·22	—	—	—	—	—	—	—	·06
Enteric fever	6·66	1·12	·44	10·24	9·77	12·64	20·16	6·43	3·40	5·67	8·36	3·17	9·01
Intermittent fever	—	—	1·32	—	·30	·60	·16	·23	—	·63	—	·32	·41
Remittent fever	—	1·87	—	—	·37	1·00	·65	·11	—	·31	·43	·63	·60
Simple continued fever ..	—	—	—	—	—	—	—	—	·68	—	—	—	·01
Heatstroke	·83	·37	·88	1·17	·81	·60	1·79	·68	—	·63	·28	—	·91
Circulatory diseases ..	·83	·37	·44	·88	·59	1·40	·33	·34	·68	·94	·43	·32	·56
Tubercle of the lungs ..	—	1·12	1·76	·44	·67	·40	·33	·34	—	·94	·28	·63	·56
Pneumonia	—	·75	·88	·29	·67	1·40	·33	—	·68	—	·14	1·58	·60
Other respiratory diseases	—	—	·44	—	—	—	·33	—	—	—	·28	—	·10
Dysentery	1·66	1·12	3·97	1·61	1·26	2·21	1·46	·90	—	·94	·71	·32	2·53
Diarrhœa	—	—	—	—	·07	·20	—	·11	—	—	—	—	·23
Hepatic Abscess	·83	·37	5·73	1·76	·59	1·00	1·79	1·69	·68	1·89	·71	2·22	1·29
All Causes	11·65	10·83	19·39	25 17	18·21	24·48	33·01	13·99	11 56	15·11	14·17	14·89	22·93

The percentage of enteric fever to total admissions in 1897 was greatest in the Hills; of ague in the Indus Valley; of remittent and simple continued fevers in Burma Inland; of pneumonia and hepatic abscess in the Convalescent Depots; of other respiratory diseases in Western Coast; of dysentery in Bengal-Orissa, where also hepatic abscess was nearly the highest; and of venereal diseases in Burma Coast.

The highest ratios among the large garrisons with a strength of over 1,000 were those of Agra, Peshawar, Meerut, Mhow, and Umballa, and all were higher than the corresponding ratios of 1896. All these stations had increased mortality from enteric fever; some, increased mortality from malarial fevers, from dysentery, from hepatic abscess. The health statistics of some stations, such as Cawnpore, Umballa, Dalhousie, Rawalpindi, and Thobba, are said by the medical officers to have been unfavourably affected either by the withdrawal of the healthy men for field service, or by the reception of broken-down men from field service.

The statistics of individual regiments show that the infantry had the highest admission and constantly sick-rate, as in the previous year; the artillery the highest invaliding rate, as in 1896; and the engineers the highest death-rate. The 1st Battalion, East Surrey Regiment, at Jhansi, had the highest constantly sick-rate, and it may be noted that it was a regiment at Jhansi which had the highest constantly sick ratio in 1896. The 1st Battalion, Shropshire Light Infantry, which suffered from cholera at Sitapur, and the 2nd Battalion, York and Lancaster Regiment, which suffered severely from enteric fever at Agra, had the highest death-rates.

Principal diseases: Influenza.—Sickness and mortality having been studied in their relation to India, to commands, to geographical groups, to stations, and to regiments, it will be convenient now to discuss the statistics of some of the chief diseases.

At the end of 1896 influenza was falling. In the course of 1897 there were three abrupt monthly rises,—in March, in June, and in October-November. The number of admissions fell suddenly again in December. The following shows the decrease of total in 1897. It also shows the monthly progress and the annual fluctuations of the disease since 1890, the first epidemic year:—

Period.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Per 1,000 of strength.
1890	—	3	473	1,451	248	69	13	2	3	—	—	1	2,263	33·4
1891	1	—	1	16	77	91	112	29	20	2	2	21	372	5·5
1892	113	53	354	241	57	4	32	8	—	—	—	—	862	12·7
1893	1	—	—	15	4	—	—	—	—	—	—	1	21	·3
1894	7	9	12	70	101	30	7	7	—	2	—	—	245	3·4
1895	14	7	52	156	66	35	17	1	5	13	23	165	554	7·8
1896	262	65	140	30	12	7	3	3	88	128	50	20	808	11·5
1897	12	10	31	9	11	30	8	8	—	54	87	12	272	4·0
Total	410	147	1,063	1,988	576	266	192	58	116	199	162	220	5,397	

The actual maximum of the individual years of the eight occurred in various different months, but over the eight-year period as a whole the greatest number of cases occurred in April and March, and the smallest number in August; 82 per cent. of the whole in the first six months of the year, and only 18 per cent. in the last six months. Geographical Groups I, II, V, VI, VIII, IX, XI, XII*a*, and XII*b* were attacked both in 1896 and 1897; Group VII, which had been affected in 1896, escaped in 1897; while Groups IV and X were spared in both years, as well as in 1895 and 1894. These two last groups lie on opposite sides of India, and contain, respectively, the European garrisons of Calcutta and Bombay, and the reason why they should escape is at

present not obvious. Twelve stations only were attacked in 1897, against twenty-five, three of them suffering only in 1897, and nine in both years, while some escaped that had been affected in 1896. Among stations, Lucknow,* Rangoon, Ranikhet, and Kasauli, had the greatest numbers of cases, Lucknow and Rangoon having been at the head of the list also in 1896. At Lucknow, Ranikhet, and Kasauli the outbreaks were compact, and were confined to two, or, at the most, three months ; while at Rangoon the disease did not finally cease till after the first eight months of the year. The average number of men constantly sick with influenza was 10, against 61 in 1896, and the average duration of a case 13 days, against 28. The returns deal, of course, only with those cases which were admitted into hospital, but there were mild cases not admitted. On page 69 is given a table showing the relation, year by year, of influenza to pneumonia, and of the influenza of the European troops to that of the native troops and to that of the prisoners. The admission ratio of the first was a little lower than that of the second, less than half that of the third.

Cholera.—General questions regarding the etiology, spread, and prevention of cholera, and the circumstances, so far as they are of importance, attending the most severe outbreaks of 1897, are discussed under Chief Diseases, page 94.

The amount and proportion of cholera were greater than in the previous year, but the ratios were somewhat lower than those of the decennium, as may be seen in the following table :—

Period.	Admissions.		Deaths.	
	Number.	Per 1,000 of strength.	Number.	Per 1,000 of strength.
1886–95	1,280	1·9	901	1·33
1896	70	1·0	63	·89
1897	117	1·7	80	1·17

The disease was at its maximum in September ; but in only three months of the year —January, March, and December—was there an absence of cases. Of the stations, Sitapur with 65 cases, or about 56 per cent. of the total for India, and Muttra with 9, suffered most. The regiments yielding the cases at these two stations respectively, were the 1st Battalion, Shropshire Light Infantry, and the 5th Lancers.

Small-pox.—The admission-rate from small-pox was a little less than a quarter, and the death-rate a little less than a half, that of the preceding year ; the former being reduced from 1·7 to 0·4, and the latter from 0·14 to 0·06. There were only 24 cases with 4 deaths, against 122 cases with 10 deaths. The admission-rates and death-rates were both below the decennial ratios of 1886-95. Not more than three cases occurred in any one station. In Burma Coast and Western Coast, as in the previous year, and in Indus Valley, Southern India, and the Hills, small-pox was absent.

Ague, Remittent Fever, Simple Continued Fever, Malta Fever.—Ague gave rise to over 25 per cent. of the admissions from all causes. The abundant and widely-distributed rainfall following on prolonged drought favoured the prevalence of malaria.

Period.	Intermittent Fever.		Remittent Fever.		Simple Continued Fever.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–95	353	·18	9	·54	57	·04
1896	239	·10	14	·40	30	—
1897	395	·41	25	·60	43	·01

* The medical officer in charge at Lucknow is somewhat inclined to think that the diagnosis should have been Dengue rather than Influenza.

The ratios were above those for the decennium. In 1897 ague ratios were high in the ndus Valley, Central India, and Upper Sub-Himalayan, and low in Burma Coast, Burma Inland, the Hills, Southern India, and Western Coast; and that that is a usual state of things, as regards the first three and the last two, may be seen from the following :—

Period.	Ratio per 1,000 of Strength.												
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
1886–95...	194·5	531·2	381·8	216·9	465·5	632·4	496·9	228·0	164·3	119·0	291·0	320·4	352·9
1896 ...	105·3	157·1	204·9	183·4	248·7	523·5	376·1	265·1	75·8	80·3	163·9	178·8	239·0
1897 ...	47·4	132·6	383·9	246·7	422·6	761·8	584·2	333·3	182·2	139·4	128·1	158·7	394·7

The great fall of ague and influenza in Burma Coast was accompanied by a great rise in simple continued fever ; and the medical officer suspects, and probably with justice, that the change is due to difference of opinion among the medical officers in the matter of the diagnosis of those fevers. The most malarious month of 1897 was November, and the least malarious February. At Barrackpore and Neemuch malaria is said to be encouraged by the deficiency of the drainage. At Nowgong malarial fever was associated with a debilitated and scorbutic condition of the men. Irrigation is said to be increasing the dampness of the climate of Mooltan, and therefore malaria. The medical officer at Karachi points out that ague now appears in the returns to the exclusion of simple continued fever, whereas many cases of the latter used to be returned at that station. He notices also the frequency of melæna. At Hyderabad malaria was increased by the unusual extent of country flooded by the Indus. The medical officer at Quetta says :—

> The parasite seen in Quetta in cases contracted locally is the unpigmented quotidian variety, viz., small intracorpuscular unpigmented bodies, whereas in cases contracted in Sind crescents and spherical extracorpuscular pigmented bodies are of common occurrence thus showing a more malignant form of malarial infection in Sind.

The reports of the results of the prophylactic issue of quinine were, on the whole, favourable, though some medical officers were doubtful.

Both morbidity and mortality from remittent fever increased in 1897. The ratios from this disease were high in the Tochi and Malakand Field Forces, mortality being high in the former. The geographical group which showed the greatest increase was Burma Inland. The medical officer blames the water-supply, which comes from what "is not much better than a large marsh," and also the deficient drainage ; and ascribes the remittent fever to malaria, which was unusually prevalent. Remittent fever, like ague, in 1897 was most prevalent in November, and least prevalent in February. This distribution is not the same as in 1896. All the fatal cases were ascribed to malaria or "climate," and the *post mortem* appearances on the whole were in accordance with the diagnosis ; though in four cases there were some swelling of the lower Peyer's patches, in one case an ulcer on the ileo-cæcal valve, in one case small transverse ulcers with general peritonitis, in three cases a little lymph on the cerebrum, in one case small patches of pneumonia, and in one case pleuro-pneumonia with a localised inflammation of the liver suggestive of incipient abscess. In one case the enlarged spleen ruptured itself.

The rise in simple continued fever was greatest in Burma Coast, Bengal-Orissa, Central India, the Deccan, and Southern India, the stations with the highest ratios being Fort Allahabad, Benares, Thayetmyo, Pallavaram, and Mandalay. The medical officer at Mandalay was the only one to attempt an explanation, and that was that the men of the garrison were new to the country. The only fatal case returned as simple continued

fever died from hyperpyrexia, and the *post morten* examination showed a greatly enlarged spleen, unusually prominent Peyer's patches, signs of commencing inflammation at the bases of the lungs, and congestion of the kidneys. Possibly an examination of the splenic pulp, or of the contents of the gall-bladder, might have revealed the presence of the enteric bacillus. In fact, as in former years, some medical officers note that cases returned as simple continued fever may have been mild cases of enteric fever ; and they differ in practice as to where they draw the line between simple continued fever and enteric fever, as well as between simple continued fever and ague. The medical officer at Rangoon notes that what is called by one medical officer "influenza" may by another be designated "simple continued fever." As an aid to diagnosis Widal's test was used at Dagshai and Quetta and at the former cultivations were made from the spleen in some cases.

On page 23 of the report for 1896 (page 50 of the Parliamentary Report) was noticed the assertion that Malta fever has been shown to occur at Subathu. On this point the medical officer at Subathu in his report for 1897 says—

"It has lately been suggested at home that many of the cases described as "typhoid" in India, "and more especially in Subathu and neighbourhood, are in reality cases of Mediterranean or "undulant fever. It is not unreasonable to suppose that a man coming from a Mediterranean station, "or from some locality where undulant fever is endemic, and having absorbed the specific poison of "that disease, may have a recrudescence in India. But, so far as careful observation entitles me to "form an opinion, I am convinced that few, if any, such cases have occurred in Subathu during the "past year. Certain of the more dubious cases returned as "remittent" may possibly have partaken "of this nature ; but all the cases returned as "enteric" were very deliberately diagnosed ; each and "every one was clinically indistinguishable from "typhoid" as observed at home ; and in every fatal "case the pathological appearances were characteristic of that disease."

As a matter of fact, no cases of Malta fever were *returned* in India ; but the question whether the disease really *occurs* in India is well deserving of further and painstaking investigation. Good authorities are of opinion that the fevers of India require, and will obtain, greater differentiation.

Enteric Fever.—The reaction against the extreme opinion that enteric fever is exclusively a water-borne disease appears to have set in, and in England in 1897 the *rôle* of the soil in the nurture and dissemination of the enteric bacillus has been magnified. Water-carriage of enteric fever, according to Robertson of Sheffield, is, as all acknowledge, a very important subject, but, at the same time, he thinks that the amount of attention it has received has to a large extent put out of account the relatively much more important subject of dust- and filth-borne enteric fever. In his experience certainly over 80 per cent. of cases of enteric fever in town districts cannot be accounted for by water or milk-carriage of the infection, or by direct infection. As he estimates that about 10 per cent. of the cases of enteric fever are due to direct infection, but a small balance is left over for water-borne enteric fever. He looks upon the soil as the home of the bacillus, the winds as its usual, the waters as its occasional, carriers. To the immediate acceptance of these views two difficulties, perhaps not insuperable, give pause. In the first place, Dr. Robertson himself was never able to find the enteric bacillus in polluted soil, unless he had previously placed it there himself in the course of his experiments. But, according to many authorities, matters are in exactly the same case as regards water. In the second place, experiments such as those of Germano, referred to on page 24 of the report for 1896, and those of Neisser, go to show that the enteric bacillus cannot survive drying sufficient to make it portable by the air ; though those of Flügge somewhat modify that conclusion, and Fischer seems to be of opinion that the enteric bacillus can survive a good deal of drying. It must be remembered, too, that if the wind cannot transport undried enteric bacilli, flies can. The enteric bacillus is said to have been found in the dust of enteric fever barracks in France and Russia ; but in this case, as in that of water, some searchers are more easily satisfied than others. Thus, Childs says of the enteric bacillus : "This parasite has practically never been found in the surroundings of man, neither in air, nor soil, nor water, nor food, nor in the sewers or deposits of filth, which constantly receive countless hosts ; except in those cases where it has been implanted for the purposes of experiment, and in certain rare instances where it has been detected in connection with some typhoid outbreak." Dr. Robertson made some very interesting experiments on the behaviour of the enteric bacillus in fields in the open air, the result of which, in brief, was that the enteric bacillus left to itself perished in a comparatively short time, but if fed by the addition of organic matter to the soil, resisted the changes of season, and flourished as long as he had opportunity to observe. Similar results were obtained by Sidney Martin, working for the Local Government Board, and are referred to by Sir Richard

Thorne in a lecture emphasising the importance of the soil in the causation of enteric fever and some other diseases, the word soil being used in the part of the lecture that concerns enteric fever in its ordinary earthy meaning. Martin found that a porous, organically contaminated soil, containing about 35 per cent. by weight of moisture, and kept at a temperature of about 37° C., was the best adapted to the growth of the enteric bacillus. Childs postulates for the occurrence of enteric fever, firstly, the presence of the specific microbe in the soil ; secondly, a population susceptible or predisposed to infection ; thirdly, pollution of the soil, with certain conditions of porosity affected by temperature and moisture or the oscillations of the ground water. In connexion with the question of soil, Thorne, Robertson, and Caley refer to the fact that through a period of years, and notwithstanding a general change in the amount of enteric fever all over the country, the same parts of England remain maximum and minimum. The maximum parts are the northern counties of England and the south-western of Wales. Parsons connects this with the comparative backwardness of sanitation and the survival of the midden system in the north of England, while Robertson points out the need for further inquiry. There are some indications that certain parts of India are more constantly distinguished by high ratios of enteric fever among European soldiers than others ; but sufficient data have not yet been collected to justify a definite opinion. It has been noticed in England that where a part of the country usually comparatively free has been severely attacked, it takes a year or so to recover itself ; and this is held to indicate a gradual "healing of the soil" in the absence of opposing circumstances. On the other hand, Childs, the author of the phrase "healing of the soil" points out that where the contamination is continuous, drastic sanitary operations are a necessary preliminary to the healing of the soil. On the other hand, Poore shows that in China, where excreta are religiously collected and place on the fields, the mortality from enteric fever among British soldiers is low. According to Robertson, the largest number of organisms is not at the surface but at a depth of 12 to 24 inches below the surface ; and in an undisturbed soil the number of organisms rapidly diminishes at a depth of 3 to 4 feet from the surface, though faults and porous strata may allow them to be carried down to great depths. The enteric bacillus planted at a depth tends to grow upwards. The effect of sunlight is limited to those organisms actually on the surface. But the chief self-cleansing processes of the soil take place neither on the surface nor in its depths, but in its upper layers. "Burying excreta," says Poore, "as is sometimes done [*i.e.*, too deeply, and firmly covered in] is "like laying down port : the bacilli are not destroyed, and only require digging up to "spread infection." The researches of Germano have been referred to above. These have now been completed ; and, premising that Germano's argument is that an organism that cannot survive drying cannot be carried alive by the wind, his results, in brief, are :—The cholera spirillum, the plague bacillus, and the enteric bacillus cannot resist drying ; the diphtheria bacillus, the pneumococcus, and the streptococcus, can live some time dry ; the most resistant of all is the *meningococcus intracellularis*, and next to it the tubercle bacillus and the staphylococcus. The somewhat peculiar opinion of Paget is that the enteric bacillus exists in virgin soil, but in such a condition that it requires education before it can produce typical enteric fever ; and that the so-called typho-malarial fever is due to an uneducated bacillus.

On the whole the opinion of the day seems to be that the bulk of ordinary enteric fever is soil-derived, but sudden widespread outbreaks water-borne. When outbreaks occur simultaneously over a wide extent of country, they may be due to some combination of polluted soil and climatic conditions, with here and there incidental secondary contamination of the water, rather than to simultaneous accidental fouling of water-supplies. A specifically polluted soil is to the inhabitants of the place a constant threat of danger through the water-supply, as well as through the many other channels by which its particles can reach the interior of the body, while a non-specifically polluted soil is only one degree less dangerous, for it is a favourable nutrient medium prepared and ready for the enteric microbe whenever it shall arrive.

To those who say that climate is nothing, the parasite everything, it may suffice to point out that it takes two to make the disease, the host and the parasite ; that these two are engaged in a life and death struggle, that even a slight advantage or disadvantage on one side may decide the result ; and that the Indian climate is certainly not bracing to the European constitution. In the same way a native of India if transported to England is depressed by the cold, has his lungs irritated, and is much more apt to fall a victim to tubercle than in his own country. Many experienced medical officers are impressed by the occurrence of cases which seem to show that over-exertion in the heat renders a man an

easier victim, and that with respect to enteric fever liability too much exercise is more dangerous than too little.

Though the presence of the enteric bacillus has been but seldom reported in the intestine or gall-bladder of men not suffering or recovering from enteric fever, there are those who believe that it is often present, and would be more often found if looked for oftener and with adequate means. According to them, men very generally carry about in their bodies the enteric baccillus, which remains quietly waiting its opportunity. That a man escapes is due either to permanent insusceptibility or to temporary insusceptibility or to the absence of the bacillus. According to them again, a man may get enteric fever in one of two ways. Either some indiscretion of diet or exercise, or a lowering climatic influence, diminishes his power of resistance and enables the bacillus, hitherto resting peacefully in his body, to become an active invader of the same ; or while he is in a susceptible condition, bacilli from the stools of another case gain access to his body through water, food, &c.

Experiments on animals by Remlinger and by Chantemesse appear to their authors to have had more satisfactory results than those of previous observers.

Osler seems now to have adopted the opinion of Sanarelli, quoted on page 25 of the report for 1894, that enteric fever is no more primarily an intestinal than small-pox is primarily a cutaneous disease. On the other hand Sidney Martin is of the old opinion that the disease probably begins at the intestine and not at the blood.

Block on two occasions cultivated the enteric bacillus from a hypodermic-syringeful of the patient's blood, and after death the bacillus was found in the liver, spleen, kidneys, and in a piece of retained placenta—along with other microbes. Takaki and Werner succeeded in finding the bacillus in blood taken from the roseola.

Cases of enteric fever without intestinal lesions have been mentioned in former reports. Osler now divides cases of enteric fever as follows :—Firstly, ordinary cases with intestinal lesions ; secondly, septicæmic cases, general infection without special local manifestations, the diagnosis being made by means of Widal's reaction and by means of cultivations of the bacillus from the organs ; thirdly, cases with localisations other than intestinal,—pulmonary, splenic, renal, cerebro-spinal ; fourthly, cases of mixed infections. This division meets with the approval of the *Lancet* reviewer. Chiari and Kraus report a number of cases in which the presence of Widal's reaction during life caused the organs to be searched for the bacillus, though there were no intestinal lesions. In some the bacillus was found in the gall-bladder, mesenteric glands, spleen, kidneys, urine ; while in others, though no bacilli were found, the fluids of the body continued to give Widal's reaction *post-mortem*. Others also have reported cases. Their experience seems to indicate that " pure septicæmic enteric fever is relatively frequent." Durham, on the other hand, is of opinion that to the bacillus of Gaertner, and not to that of Eberth, belong the similar cases of " septicæmic enteric fever " which he had seen described as occurring in France, in which death occurred before typical typhoid lesions developed. Some of the observers who have brought forward the cases without intestinal lesions point out that if the bacillus is to be found at all in a body it will likely be found in the gall-bladder ; and that in the gall-bladder it may remain more or less inactive for long periods after health is re-established, during which at any moment it may be excreted into the intestine, and so perhaps make a healthy man a source of infection to others. The bacillus is even said to have been found in the gall-bladder in one case in which there was no history of previous enteric fever. Horton Smith reports that it was found in the fæces of convalescents 12 days after defervescence by Brieger, and 41 days after by Lazarus, and that he himself found it in urine 22 days after. It has also been found in abscesses years after.

Sterling reports that without the aid of Elsner's method he succeeded in demonstrating the enteric bacillus in fæces in only 16·4 per cent. of the cases, whereas by the use of Elsner's process he was successful in 60 per cent. ; but that, while a positive result is decisive, a negative is not so. He detected the bacillus in 60 per cent. of the patients, in 66 per cent. of the examinations made, in 44 per cent. of the examinations in the first week of the fever, and in 87 per cent. of the examinations in the second and third weeks. Others have characterised the method as good but requiring a long time ; while by at least three observers it has been unfavourably reported on. None of the newest methods seem to have won for themselves immediate general approval and adoption. In several volumes of this report the enormous difficulty of the diagnosis of the enteric bacillus, especially in water, has been emphasised ; and a similar opinion is expressed in the Army Medical

Department Report for 1895. Van de Velde, among others, states that he has never succeeded in finding the enteric bacillus in water. On the other hand, it is well known in India how frequently Mr. Hankin finds the bacillus, or something very like it, in water and elsewhere. Mr. Hankin, in his Annual Report for 1897 says,—

" The enteric microbe was searched for in 87 specimens of water, and detected in 29 instances. The " isolation of the enteric microbe is known to be a difficult matter, and as some doubt has been " expressed whether the enteric microbes and microbes suspicious of enteric that I have isolated from " water really deserve that name, I have submitted a dozen of these microbes, obtained from as many " different specimens of water, to Professor Pfeiffer of Berlin, the leading European authority on the " subject. He informs me that he has subjected these cultures to a minute examination, and that all, " or nearly all, are typical enteric in every respect."

Kister is one of the latest observers who report favourably on the use of Widal's test in the examination of suspected bacilli from water; and Hankin in some of his analytical reports mentions the finding of bacilli, which, besides presenting other characters of the enteric bacillus, reacted with Widal's serum. Durham divides the bacilli which cause the chief difficulty in diagnosis into three groups—the Gaertner group, the Eberth group, and the Escherich group; but these groups are not sharply defined one from another, and it is sometimes only by a majority of properties that a given microbe is assigned to one group rather than to another. Durham also asserts that the bacillus of Gaertner has been known to give Widal's reaction with enteric serum, and this appears to be accepted by Sidney Martin. Durham, in fact, considers that the bacillus of Gaertner causes a fever without intestinal lesions, which has been mistaken for enteric fever.

A case has been published of fever which ended fatally by perforation of the intestine, a virulent colon bacillus being found in the spleen. As usual a large number of diseases were attributed to the *bacillus coli*; but in some of the cases the infection may have been secondary, or may even have been *post-mortem*. It is believed to be possible that active infection by the enteric bacillus and the *bacillus coli* may be simultaneous, and experiment gives some countenance to the idea that the two may aid each other in their work of destruction.

The spread of enteric fever through the air around the patient is generally doubted; but Dr. Budd strongly maintained that such communication was not only possible but frequent, and Dr. Corfield believes that he was right. There are others who believe in the direct infectiousness of enteric fever, especially in the crowded dwellings of the poor; but it may be considered doubtful whether the disease would, even under such circumstances, be conveyed without the agency of dirty fingers and other uncleanlinesses.

The idea that flies convey infection is probably a very old one. Of late years many medical officers have referred to the matter in reports on outbreaks of enteric fever or cholera; and many of the cook-houses for British soldiers in India are protected with wire gauze for the very purpose of shielding food from the visits of flies, which may have come from latrines or other unclean resting-places. Among the neatest bacteriological investigations of the subject was one in which flies were allowed to alight upon a culture of *bacillus prodigiosus*, this bacillus being chosen because of the striking red colour its cultivations display, and then given opportunity to walk over the surface of sliced sterilised potato. The results were, as might have been expected, positive and conclusive. Various other experiments, also all with positive results, have been made with flies and other insects as to their power of conveying the enteric, cholera, cholera nostras, tubercle, and anthrax bacilli, and the staphylococcus. The microbes in an active condition were also found in the excrement deposited broadcast by the flies. Lately a report, couched in somewhat superlative terms, has been published in the *Lancet* to the effect that an American scientific commission appointed to examine into the causation of enteric fever in the military camps, had come to the conclusion that flies were the chief agents in the spread of the disease. Very interesting and important, though not bearing directly on enteric fever, are the investigations of Amedeo Berlese. His experiments prove conclusively the great part taken by insects, especially ants, and several kinds of fly, not only in the distribution (as was already known), but also in the preservation and multiplication of alcoholic ferments. Insects, far more than the atmospheric air, contribute to the dissemination of yeasts, which they convey rather internally than externally. There is, moreover, reason for believing that during the cold season some yeasts are chiefly preserved, and perhaps increased, within the organs of insects.

The most important recent researches on the presence of the enteric bacillus in the urine are those of Petruschky. He found, like others, that the excretion of enteric

bacilli in the urine is relatively rare, and begins so late in the course of the disease as to be useless for diagnostic purposes. But he also discovered that in many cases the excretion of bacilli may be so enormous that millions may be contained in one cubic centimetre of the urine ; and that this hyper-excretion may go on for weeks, and, what is obviously of great importance, may continue so long after the beginning of convalescence, as to constitute a real, though hitherto unsuspected, danger to others. He points out that such a case might cause a sudden great increase in the contamination of a water-supply ; and the importance of frequent examination of the water. He also gives the following account of an involuntary experiment on the human subject. During the absence of the sister who was nursing him, a delirious patient suffering from enteric fever urinated into a champagne bottle that was standing by his bedside. When the sister poured out the fluid into a glass to give to the patient, she was struck by its cloudy appearance, and tasted it to see if it was all right. Though she at once recognised what it was, and was seized with vomiting, yet in about 12 days she fell ill of enteric fever. Urine which contains these large quantities of bacilli is always cloudy. He has not succeeded in finding similar exaggerated excretions of bacilli in fæces.

Besides the importance of examining the sources of the water-supply and their surroundings, two points have lately been insisted on : the necessity of obtaining a local standard of water, the necessity of frequent examination and of not trusting to the negative evidence of a single sample. That the first is a convenience as well as necessity has been emphasised by Duclaux. Opinions differ as to the meaning of the presence of the colon bacillus in water, but all seem agreed that its presence in abundance always indicates danger, being due to pollution of the water by alvine discharges or sewage or fæcal dust. The colon bacillus isolated from water sometimes gives confusing seral reactions. The following is condensed from a leader in the *Lancet* on the report of Adams (chemical) and Washbourn (bacteriological) on the Farleigh water-supply of Maidstone :—

" It becomes essential to have an intimate knowledge of the composition of the pure water of the " district, before it is possible to form an accurate estimate as to the purity of any sample from " a source within the district. Except within narrow limits, there should be no departure whatever " from that standard. Departure from the standard signifies pollution. The nature of the pollution, " though of a harmless sort one day, may be changed for a dangerous sort another day. It may " be accepted almost as an axiom that any water which at all seasons and under varying conditions " remains unaltered for, say 12 months, may be looked upon as a permanently good water ; whilst " any water, from whatever source, which undergoes even slight changes as regards its mineral " and organic constituents in solution, must be recognised as a water which, though not actually " polluted, is always open to suspicion, from the fact that it is open to contamination, sometimes, of " course, of a specific nature. Even slight irregular variations are more important than the presence of " moderate but invariable quantities of certain substances which are sometimes supposed to indicate " by their presence a certain amount of contamination. . . . It is impossible to make an arbitrary " limit as to the number of bacteria which is to be taken as the standard of purity ; but Koch's " dictum may be accepted that water containing fewer than 100 bacteria in the cubic centimetre may " be considered a good water, provided they are the ordinary water-bacteria. The presence of one or " two coli bacteria in 100 c.c. of water is probably not a matter of much importance, although the " presence of a large number (such, for example, as the 60 colonies in the c.c. in one of the samples " examined) is a definite proof of contamination with animal excreta."

Reference is made on the next and following pages to the cases in which the enteric bacillus was found in water-supplies in India during 1897 ; and on the preceding page are given some important remarks of Mr. Hankin on the subject. Some careful work on filters has been done by Sims Woodhead and Cartwright Wood : many filters of different makes were tested, and their individual merits and faults clearly stated. But it must always be remembered that it is never wise to trust to filtration for safety, when the water is known to be contaminated : the way of wisdom is to see to the removal of the contamination at its source. Some striking statistics of the result of an improved water-supply in diminishing the morbidity and mortality from enteric fever have been published. It was found in the Agra laboratory that one way by which pure water could be contaminated was by the pathogenic microbe growing through the porous walls of the water-vessels into the contained water. This would seem to require confirmation, as it appears to be at variance with the results of Abba quoted on page 24 of the report for 1896. Poore has drawn attention to the dangerous dead-house practice of washing out the intestines of bodies of men dead of enteric fever and letting the intestinal contents and the water flow away into the drains without any attempt at disinfection. This point should be attended to in India, as the drains from dead-houses there are mostly simple surface-drains.

Under the ordinary conditions in which milk reaches and is kept by the consumer the enteric bacillus is capable of maintaining its existence in it, but without multiplication; in fact, it undergoes diminution, the rapidity of which depends on the number of rival microbes present. It can also exist in sterilised milk curdled by the *bacillus lactis*, and also in sour milk, so that it may possibly find its way into curd-cheese. It is said to survive for 48 hours in butter-milk. An epidemic in Hamburg, which chiefly affected women and children, was considered to be due to those properties of the bacillus. In bad and dangerous milk a bacillus which is either the colon bacillus or a near relation to it has been found.

The general opinion among those best qualified to judge is, at present, that the only possible way in which sewer gas and evil-smelling air can contribute to the causation of enteric fever is by lowering the general health and resisting power of men.

Heat remains the best disinfectant agent for the prevention of the disease—cooking of all food, boiling of water and milk, cremation of stools; and these measures have been practised to a considerable extent in India. All authorities seem agreed that pathological stools should be burned, and certainly in times of epidemics. But as it is not always possible to know that a stool is pathological and pathogenic, and as the burning of all night-soil is out of the question, the greatest attention should be paid to the proper disposal of the dejecta by superficial burial. Those concerned should lay to heart the words of Poore, quoted in the present paragraph under the heading "Soil," and also the following of the same author:—

"In order to prevent contamination of the water, it is best to burn the stools. But in the country "it would be best to put the excreta near the top of a recently-tilled humus. Merely digging a "trench, filling it with excreta, and covering it firmly with soil simply preserves the fæces, and "does not lead to their disintegration."

At hill stations also all stools known to be those of enteric fever should be destroyed. For the burial of the rest of the night-soil, which will always contain some dangerous stools, there is difficulty in getting sufficient land on the hill-sides; and the best plan is to convey the night-soil in wire-tramways down the hillside as far as may be thought desirable, or till a suitable trenching ground is reached. This system is working well at Murree, Gharial, Kuldunnah, and Lower Topa.

It may be of interest to record that P. C. Smith states that the enteric fever death-rate in London, which was in the decennium 1871-80 240 per million, fell to 190 in the decennium 1881-90, to 140 in 1895, and to 127 in 1896.

As usual many medical officers point out the influence of youth and of recent arrival in India; and some call attention to the increase of enteric fever subsequent to the arrival in a station of a new regiment, or of fresh drafts from England. The medical officer at Ahmednagar goes so far as to say that newcomers to that station are as such more liable to the disease, even though it be not their first term of residence there. Three men appear to have already contracted the infection before they landed in India. In 1897, as in former years, some cases were held to have originated *en route* from Bombay to inland stations, and the medical officer of Mhow calls for more stringent measures to protect fresh arrivals at Bombay, at Deolali, at the rest-camps, and while in the train. Again, medical officers frequently noted, especially in the case of hill stations, that the disease must have been contracted before arrival, either from impurities encountered on the march, or from a cause existing in the previous station, so that the station where the disease was treated was not always the station in which it was contracted. For example, eleven of the cases treated at Peshawar are said to have originated on field service. Some patients acknowledged having drunk foul or doubtful water in native villages, by the roadside, when out shooting, when bathing in a dirty stream, in the bazar, or from a forbidden source in cantonment. At Jhansi, Bangalore, Deesa, Subathu, and Amritsar it was noticed that men employed away from barracks, as military telegraph signallers, or policemen, or in practice and exercise camps, or at training and musketry, were liable to attack, whether from fatigue and exposure, or from having had opportunity to drink unclean water. While in some cases heat and fatigue were held to have been predisposing influences, in others illness was dated from a chill due to a wetting, or from a chill following overheating. The medical officer at Mhow considered that insufficient clothing had rendered a certain body of men more vulnerable. The water-supply was considered liable to contamination at Umballa, Dagshai, Subathu, Poonamallee, Mandalay, Ahmednagar, Mhow, Nasirabad, Hyderabad, and Sitabaldi; while in Fort Lahore, examination having thrown suspicion upon the well-water, recourse was had to a fresh source of supply.

Apparently, Calcutta, Attock, Madras, Bangalore, Wellington, Ramandrug, Rangoon, Thayetmyo, Purandhur, Nasirabad, and Taragarh are still exposed to the danger involved in a double water-supply ; and the medical officer of Nasirabad mentions that men had confessed to having drunk of the water reserved for washing and gardening, and notified by sign-boards as "Not for drinking," a water in which the presence of the enteric bacillus had several times been reported. Besides this, in the drinking-water of Lucknow, Fatehgarh, Meerut, Muttra, Agra, Subathu, Meean Meer, Amritsar, Cherat, Mhow, and Deesa, the bacillus, or a near relation of it, was found, mostly, or in every case, by Mr. Hankin. Two medical officers report that the same bacteriologist discovered the enteric bacillus in specimens of water that had been boiled and passed through a Pasteur filter. Mr. Hankin found the bacillus in milk from Fatehgarh and Dagshai. On the other hand, the result of the examination of water from Sitapur, Ranikhet, Chakrata, Jhansi, Dagshai, Solon, and Ahmednagar, was negative. At Quetta the arrangements for the supply of water to the kitchens and to the soda-water factories was considered such as to risk contamination of the water, and the *bacillus coli* is said to have been found in a specimen of soda water. In the beginning of 1898 Surgeon-Major Davies, on special duty, found a bacillus of the colon group in the water of the Mhow supply. Where *pakhals* and *mussacks* continue to be used, it appears, at least on paper, that systematic efforts are made to secure their constant disinfection, the most difficult cases being those where the use of leather vessels coincides with a double water-supply, and necessitates the provision of two sets of *mussacks* and *pakhals*. In some cases it appears that dislike of boiled water, or of water treated with permanganate of potash, was the cause of men resorting to forbidden sources, and anyone with a taste for water must sympathise with these men. The combined result of six stations was that 65 cases occurred among total abstainers, and 121 in non-abstainers, or 35 and 65 per cent. respectively. But, as their average annual strengths cannot be obtained, no conclusion can be drawn as to the relative liability of those two classes. An outbreak in Umballa was attributed to water drawn by a *bhisti*, to save himself trouble, from a well close to some old filth pits. At Indore a patient stated that he had drunk a quantity of soda water in a brothel about a week before the onset of his illness ; at Hyderabad a soldier had drunk lemonade in the bazar ten days before admission ; while at Chakrata a man who contracted the disease had drunk out of the bottle of a comrade in hospital suffering from enteric fever, the supposition being that the latter had contaminated his bottle in using it. An outbreak at Cherat was traced to the adulteration of milk with the water of a dirty tank, this water containing the enteric bacillus. The butter and milk were believed by a committee to have originated the first outbreak of the year at Mhow ; and, though doubts have been thrown upon the validity of this conclusion, it was found that the dairy arrangements were very defective. As usual, some medical officers point to the comparative immunity of women and children as an argument against the probability of the disease having been carried by the water or milk supplies, or to the scanty numbers and sporadic distribution of cases as an argument against it having been water-borne. The enteric fever of some stations was described as not epidemic but endemic, with regular spring and autumn exacerbations. The medical officers of three or four stations point out that all the attention lavished on the disinfection of the water has made little difference in the amount of enteric fever, and draw the conclusion that enteric fever is mostly contracted in the bazars, away from the barracks with their sanitary arrangements. Most medical officers are of opinion that much enteric fever is contracted in the bazars, and especially in the brothels ; and in support the medical officer of Fort Allahabad notes that eight out of nine cases occurred in the persons of bachelors, one of them having primary syphilis when admitted for the fever ; while, on the other hand, it is said by the medical officer of Nasirabad that no cases have been admitted from the married quarters for some years. None of the reports for 1897 mention the effect on the amount of enteric fever of placing the bazar out of bounds, though there are nearly a dozen references to the effects of this measure upon the statistics of venereal disease. The danger from the careless and dirty habits of natives allowed to be about barracks, and especially of native cooks, is insisted on by several medical officers. Two of them suggest that the men should be made to cook their own food, and this reform has actually been carried out in the case of Subathu. In some stations elaborate rules have been introduced to secure cleanliness in the kitchens, and measures have been taken to exclude flies. An outbreak of enteric fever in the hospital at Jhansi was attributed to the surreptitious introduction from outside of bazar-made sweetmeats and butter. At Dagshai the bread was freed from suspicion by examination. The medical officer at Nasirabad thinks there may be something in the fact that enteric fever is most common when there is most dust blowing about. It was discovered by the medical officer at

Campbellpur that the clothing of enteric patients admitted to hospital was stored without being washed, and, in the event of the patient's death, was sold without having been disinfected. At Dagshai it was noticed, as in some other years, that tonsillitis and sore-throat were prevalent at the same time as enteric fever. Of Bernardmyo, which was first occupied in 1888, it is said that there is no record of the occurrence there of enteric fever; and Darjeeling and Colaba are reported as comparatively immune. The reasons given for immunity in the case of Roorkee were a small garrison and no drafts arriving; in the case of Dagshai military prison, the not allowing any natives inside; in the case of Murree, a good and abundant water supply and careful sanitary attention; in the case of Colaba, the fact that the water-supply is at no point liable to contamination. Again, the reasons given for a diminution of the disease were, at Shahjahanpur, keeping natives away from the barracks; at Ranikhet the great precautions taken to secure cleanliness of water and milk; and at Dalhousie the sanitary measures of recent years. Among the measures considered to have been successful in staying an outbreak were removal from the neighbourhood of the unclean water (Umballa); boiling and permanganating the water, and inoculation of the supply with *micrococcus Ghadiallii* (Meean Meer); permanganating the water (Kamptee). The presence of the *micrococcus Ghadiallii* in the milk used by a regiment at Dagshai did not, however, apparently prevent that corps from suffering severely from enteric fever. That non-commissioned officers at Umballa suffered little was considered possibly due to the fact that only mineral waters were consumed at their messes. Some regiments and batteries have made very complete arrangements for securing cleanliness in their aërated water factories and in their dairies, but, as a rule, the existence of weak points is reported. For the purification of water alum appears to be used only in about half-a-dozen stations, whereas boiling and permanganating with more or less thoroughness seem to be general. The Larymore boiler, as made and used by the jail department of Bengal, is being introduced at some stations, and has so far met with approval. Incineration of enteric stools is reported from Dagshai, Subathu, Jutogh, Mooltan, and Gharial; but it seems that those are not by any means the only stations in which such a procedure is carried out. At Chakrata urine, fæces, &c., were boiled. Finally, on account of the difficulty of maintaining biological cleanliness in all things in India, some medical officers, amongst whom is he of Chakrata, desire the prophylactic inoculation of all men coming to the country. Out of the 2,214 cases of enteric fever which occurred throughout the army of India in 1897, 49 are noticed as having declared themselves among patients in hospital or among attendants. Out of these, 11 were in hospital for early venereal disease, 19 were in hospital for late venereal or other diseases, and 19 were attendants on enteric fever cases. The number of attacked attendants returned is much greater than usual. A second attack of enteric fever was the lot of a man at Meerut, whose first attack had been at Cairo. In four cases at Mhow and in one case each at Pachmarhi, Meerut, Sialkot, St. Thomas' Mount, Bangalore, Belgam and Rangoon an association, contemporaneous or successive, of enteric fever with dysentery was observed. A case each of enteric fever at Sitapur, Sialkot, Belgam, and Quetta was complicated with abscess of the liver; while in two cases of abscess of the liver, which occurred, respectively, at Lucknow and at Secunderabad, the origin of the abscesses was stated to have been the intestinal ulceration of enteric fever.

Medical officers have reported on the outbreaks in the case of which the drinking water was suspected, or was said to contain the enteric bacillus; of the measures considered to have been effectual in preventing or checking the disease; and especially of the results obtained by boiling the drinking water, or by adding to it potassium permanganate or other chemicals. Instances are given where the purification of the water was not properly carried out, or was even so carelessly managed as to be worse than useless—to be mischievous. But the disappointing figures in the following table seem to show either that the measures in question were more generally mismanaged than would appear from the reports, or that they are of no use, or that the main sources of the infection were outside the regular water-supply. If the actual increase of enteric fever was not due to contamination of water from unintelligent handling after it had been drawn for use, it may conceivably have been due to the concentration of sanitary attention on the water-supply to the comparative neglect of those other sources of infection. It seems hardly likely, however, that good measures put in force simultaneously throughout the British cantonments of India, should have been everywhere mismanaged, and should in two years have produced absolutely no good effect. The alternatives, therefore, seem to be either that the measures were not of a kind to do good, or that, being good, they were not applied to the cause of the evil. The same suspicion which has already arisen in England, arises in India, that, while sudden extensive epidemics are due to contamination of the water-supply,

the mass of ordinary cases that occur singly or in small groups must have some other origin, or, more probably, origins. There is uncleanliness of soil, of cook-houses, of latrines, and there are the many uncleanlinesses of the native bazar.

Commands.	Year.	Enteric Fever.		
		Admissions.	Ratio per 1,000 of strength.	Difference.
Bengal	1896	679	30·2	+ 8·9
	1897	786	39·1	
Punjab	1896	488	25·9	+ 16·2
	1897	724	42·1	
Madras	1896	227	16·8	+ 2·4
	1897	237	19·2	
Bombay	1896	401	25·5	— 5·1
	1897	303	20·4	
India	1896	1,795	25·5	+ 6·9
	1897	2,214	32·4	

No explanation can be offered as to the exceptional experience of the Bombay Command. The chief reductions in the command were at Quetta, Kirkee, Deolali; but the "medical transactions" of those stations throw no light on the point.

Enteric Fever in 1897.—There was a considerable increase of both morbidity and mortality from enteric fever in 1897. The admission ratio rose from 25·5 to 32·4, and the death ratio from 6·31 to 9·01, a difference of 6·9 and 2·70 per 1,000, respectively. There were 2,214 admissions and 616 deaths, against 1,795 and 445 in 1896. The average number of men constantly sick from enteric fever was 297, and the average duration of a case was 53 days. The total loss of service due to the disease was about 108,350 days. At Dagshai and Quetta Widal's test was employed as a means of diagnosis.

Fever Mortality.—The following table shows an increase in total fever mortality, which may with some reason be ascribed to the greater youthfulness and less average length of service of the soldiers of to-day :—

—	1870–79.			1881–90.†			1896.			1897.		
	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.
Army of India	2·03	1·42	3·45	3·79	·70	4·49	6·31	·50	6·81	9·01	1·02	10·03

* Intermittent, remittent, and simple continued fevers.

† Excluding troops on active service in Burma during 1885 to 1887.

As compared with the decennia, 1896 exhibits a more usual state of matters than 1897,—an increase of mortality from enteric fever accompanied by a decrease in mortality from the other fevers, which condition of things is usually, and probably with right, ascribed partly to increased susceptibility to enteric fever on the part of the Army from

youth and recent arrival, and partly to the increasing frequency with which the diagnosis of enteric fever has been made. The year 1897 had a high death-rate from "other fevers," because it was a very malarious year. But the statistics of the last twelve years lend no support to the supposition that prevalence of and mortality from Indian enteric fever vary directly as the malariousness of the year.

The following table shows enteric fever in the geographical groups in the decennium 1886-95 and in the last two years :—

Admissions per 1,000.

Period.	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.
1886–95 ...	5·7	5·5	7·7	27·7	25·4	15·6	23·9	17·0	5·8	12·1	25·1	13·9
1896	13·0	4·5	18·3	40·0	19·8	23·8	30·4	23·1	17·4	16·0	47·2	10·3
1897	0·8	1·1	11·0	36·9	33·5	22·3	63·7	24·3	10·2	26·8	49·7	14·9

It shows that Groups V, VI, VIII, and XII*a* especially, are apt to have high ratios of admission from enteric fever, and Groups II and X, and, to a less extent, I and IV, low ratios. It also shows at a glance how the groups compare with each other in 1897, and how 1897 compares with 1896 or with the decennium. Group VIII had the highest ratio of 1897, and Group XII*a* the next highest, and in the same two groups also, but in the reverse order, the percentage of enteric fever in total admissions was greatest. The table also shows that, whereas in nine groups the ratios of both 1896 and 1897 were higher than the corresponding ratios of the decennium, only in Burma Inland were the ratios of both years lower than the decennial ratios.

As regards enteric fever in stations the following shows those garrisons which had an average strength of over 1,000 in 1897, with the decennial ratios for reference :—

Stations.	1897.		Decennium, 1886–95.	
	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
Agra	166·4	45·04	24·0	7·66
Umballa	64·1	15·32	21·7	5·41
Mhow	49·0	16·95	27·5	6·78
Lucknow	48·5	11·93	37·3	7·07
Meerut	47·4	18·58	26·8	7·83
Allahabad*	44·8	14·34	24·2	4·84
Peshawar	44·2	26·93	18·7	7·88
Bangalore	40·2	7·20	16·0	3·47
Secunderabad ...	36·2	8·77	23·7	6·04
Rawalpindi	32·2	7·79	24·5	6·85
Rangoon	22·6	6·60	5·4	2·55
Quetta	22·5	4·77	15·0	3·15
Poona	18·1	2·52	15·4	5·06
Bareilly	14·7	5·50	39·8	9·41
Wellington	11·7	2·94	7·5	2·46
Kurrachee	8·2	3·64	13·8	3·07
Colaba	3·5	·89	4·9	1·83
Fort Dufferin ...	2·0	1·99	6·8†	2·47†
Mooltan	1·9	·96	16·8	4·18
Fort William	—	—	4·3	2·13
Aden	—	—	3·5	1·81

* Including Fort Allahabad.
† Eight Years.

The high position occupied by the decennial admission ratios of Bareilly and Lucknow will be observed, and the low position of the ratios of Aden, Calcutta, Bombay, and Rangoon.

In regiments the admission and death rates were highest in the cavalry; there was no enteric fever among the engineers, and, next to them, the artillery suffered least. The regiments which had an admission rate over 100 per 1,000 and a death-rate over 40 per 1,000 were the 1st Battalion, North Staffordshire, at Umballa, and the 2nd Battalion, York and Lancaster, at Agra. The former arrived from Egypt on the 1st November, 1897, and the latter from Mauritius and South Africa on the 21st February 1897. In the report for 1896 it is mentioned that one of the regiments that suffered most in that year had arrived during the year from Mauritius. In 1897 the North Staffordshire had 51 cases and 8 deaths, the York and Lancaster 165 cases and 45 deaths. The 1st Battalion, Royal West Surrey, and the 1st Battalion, East Kent, had also admission ratios over 100 per mille, and five other regiments admission ratios over 50 per mille. All but one of these seven regiments received over 100 men from England during the year.

With regard to the relation of mortality from enteric fever to age and length of residence in India, the general results confirm those of former years. The ratio of mortality from enteric fever per 1,000 of strength was greatest in the age-period 20—25, and the relative liability of the same period was 46 per cent. In the same age-period the total number of deaths from enteric fever was 417, and out of a hundred deaths from all causes 56 were from enteric fever. Lastly, out of the total number that died at all ages from enteric fever 76 per cent. were between 20 and 25 years of age. Again, the ratio of mortality from enteric fever per 1,000 of strength was highest in the first year of residence, and the liability in the same year was 36 per cent. In the first year the total number of deaths from enteric fever was 215, and 64 out of every hundred deaths from all causes were from enteric fever. Lastly, out of the total number that died at all periods of residence from enteric fever, 39 per cent. were in the first year of Indian residence.

The age period 20—25 included 52 per cent. of the total strength of the Army, and in the same period the liability to fall sick of enteric fever was greatest, 44 per cent. In the succeeding periods the liability rapidly and gradually declined. Again, 19 per cent. of the men of the Army were of less than one year's service in India, and it was among the men of this percentage that the liability to contract enteric fever was greatest, the liability thereafter markedly declining. Since arrivals have increased, and since the percentage in the Army of men under 25 years of age and of men with less than 5 years' Indian residence has been gradually mounting, the admission ratio from enteric fever has also been rising. The greater has become the supply of susceptible material, the more the disease has prevailed.

In the period 1886–95 as a whole the chief enteric fever season, though the disease occurred in all months, was the six months April—September, with one maximum in May and another in August:—

Year.*	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000.
1886–95†	518	418	689	1,427	1,795	1,365	1,441	1,718	1,400	923	745	879	13,318	19·6
1897† ...	86	79	147	313	223	168	179	238	232	131	207	211	2,214	32·4

* The warning given in the previous report as to the months not being calendar months applies to this report also.
† Including men on Field Service.

In 1897 the greatest prevalence of enteric fever was in April and May, and again in August and September; of simple continued fever in June and July; of remittent fever in November, September, and October. Of the larger groups Southern India had its enteric fever maxima in February and July, the Deccan in March and September, the Indus Valley in March and November, the Hills in April and July, Central India in April and August, Gangetic Plain and Upper Sub-Himalayan in May and December.

Plague.—In the European army of India there occurred only 5 cases of plague, and none of them proved fatal:

	Admissions.
Bombay (Colaba)	3
Poona	1
Purandhar	1
	5

The medical officer at Colaba says that the disease having been prevalent in the city of Bombay since September 1896, and a few cases having occurred within the European lines at Colaba among native servants and employés during the months of December 1896 and January 1897, the first case was admitted to the station hospital from the 3rd Company, Eastern Division, Royal Artillery, in Fort Mahaluxmi on the 31st January 1897, the second from the 2nd Battalion, Royal Dublin Fusiliers, on the 6th March, and the third from the same regiment on the 7th March. In all three cases the diagnosis was made in consultation; and the two last cases were seen by Dr. Yersin, who concurred in the diagnosis. The man found to have plague at Poona on the 29th September 1897 was a Bombardier, Royal Artillery, employed as a clerk in the District Staff Office, and living in the *sadar bazar*. The case at Purandhar occurred (date not given) in the person of a convalescent soldier sent up from Kamptee for climatic debility; and the man, says the medical officer, probably contracted the disease on his way up.

Respiratory Diseases caused less sickness and mortality than in the preceding year.

Of the commands, the Punjab had, as usual, the highest death-rate. As to groups, if the Convalescent Depôts be excluded, the greatest prevalence was, as usual, in the Indus Valley. No explanation is given of the large amount of bronchial affections at Calcutta, Mandalay and some other stations; at Ahmedabad and Bellary the cases were mild, and were ascribed to chills. Of the field forces, that of Tirah was the one which suffered most from respiratory disease, especially the non-pneumonic forms.

Possibly in connexion with the diminution of influenza, the admission and death-rates from pneumonia fell. Of the commands, the Punjab had the highest death-rate, as usual. The Indus Valley was, as usual, the group in which pneumonia was most prevalent; but in 1897 the ratio of the Convalescent Depôts was as high as that of the Indus Valley, and that of Upper Sub-Himalayan came only third, instead of, as usual, second. Peshawar had the highest ratio in the Indus Valley, and the medical officer states that malaria played an important part in the causation of the disease. The six deaths at Peshawar was the maximum at any one station; and medical officers do not appear to have felt called upon to dwell upon the causation in their reports. The disease was more evenly distributed throughout the months of the year than in 1896, the maximum being suddenly reached in the two most malarious months, November and December, when cold weather was establishing itself, and when malaria in 1897 was prevalent. These facts are evidently connected with the peculiar weather of the year, which has already been described. Pneumonia was most prevalent in the Tirah Force, the field forces being looked at alone, next in the Malakand Force; while there was no mortality from it in the Tochi and Mohmund Forces, and no cases of it at all in the Kohat-Kurram Force.

The number of European soldiers constantly sick from pneumonia was nearly 18, against 35 in 1896, and the average duration of a case about 31 days, against 35.

Dysentery and Diarrhœa.—The admission and death-rates from dysentery and diarrhœa rose very much. This is presumably due partly to the abundant monsoon rainfall following on a drought, and partly to the exposure and hardship to which the portion of the army on field service was exposed:

Period.	Dysentery.		Diarrhœa.	
	Admissions per 1,000	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–95	30	·73	32	·06
1896	26	·67	20	·01
1897	46	2·53	33	·23

The reason why the India ratio exceeds that of any of the commands is that "India" includes the field forces. Dysentery was most prevalent in the Madras Command and in the Bengal-Orissa and Southern India groups. The same command and groups had the highest percentages of dysentery in total cases, as may be seen in the Tables on pages 42 and 44. It is usual for Bengal-Orissa to have a high dysentery ratio. Dysentery was most prevalent in the period August–November, inclusive, the maximum month being November, and the minimum January. Of stations Secunderabad, Peshawar, and Rawalpindi had the most cases ; and Barrackpore and St. Thomas' Mount had the highest ratios for stations, and the Tochi by far the highest ratio for field forces.

The exact relation of the *amœba coli* to dysentery is still a matter of dispute and of doubt, which will probably only be cleared up when a successful method of cultivating the *amœba* has been discovered. Powell in Assam states that he has frequently demonstrated the *amœba coli* in dysenteric stools.

Hepatitis.—While the admission rate from hepatitis (including abscess of the liver) fell from 23 to 20 per 1,000 the death-rate rose from 1·25 to 1·32.

Venereal Disease.—From venereal disease the admission rate for India was 485·7, against 511·6 in the previous year and 522·3 in 1895. In other words, in 1897 for every 1,000 men there were nearly 26 fewer admissions to hospital for venereal disease than in 1896. The reduction appears to have been connected with the employment of a large number of men on field service in the second half of the year, as the number of venereal admissions was much lower from July to December than from January to June. In 1897 there were 2,991·59 (against 3,162·43) men constantly sick in hospital from venereal disease, equivalent to about three regiments. Excluding from the calculation men on field service, the average stay of a case of venereal disease in hospital was 33·32 days (against 32·10 in 1896, and 31·49 in 1895) ; and the total loss of service was about 1,091,930 days (against 1,157,449 in 1896, and 1,155,167 in 1895). There were 23 deaths, 0·34 per 1,000 of strength,* and 662 invalidings, 9·68 per 1,000, *directly* due to venereal disease, against, in 1896, 14, or 0·20 per 1,000 and 479, or 6·80 per 1,000.

The ratio of venereal disease to strength increased in 57 stations and decreased in 47. The highest ratios (over 900 per 1,000) were at Shahjahanpur, Chakrata, Saugor, and Ahmedabad. The greatest increases of ratio (increases of more than 150 per 1,000) were at Benares, Allahabad, Sitapur, Fatehgarh, and Chakrata in the Bengal Command ; Attock, Solon, Ghora Dhaka, and Cherat in the Punjab command ; Cannanore (strength under 100), Ramandrug (strength under 100), Poonamallee, and "on the march" in the Madras Command ; Kamptee in the Bombay Command.

A comparison of the commands shows that there was a decrease in Bombay only, a decrease greater than the increase of the other commands put together. The smallest increase was in the Punjab. As in the two years preceding, Bengal had the highest ratio, and the Punjab the lowest.

In 49 stations, against 46, the admission rate for secondary syphilis was over 100 per 1,000 of strength, the highest ratios being those of Poonamallee (as in 1896 and 1895), Taragarh (as in 1896 : strength under 100), Chakrata, Ramandrug (strength under 100), and Belgam ; and in 21 other stations, against 22, it was over 75 per 1,000.

For India the ratio of primary syphilis *plus* soft chancre diminished by 24·7, and the ratio of gonorrhœa by 5·3, while the ratio of secondary syphilis increased by 4·2 ; the net result being a decrease in total venereal disease, as already mentioned. While the secondary syphilis ratio of 1897 was greater than that of 1896 by 4·2, that of 1896 had been greater than that of 1895 by 12·8. In 1897 the Bengal Command had the highest ratio for primary syphilis *plus* soft chancre, and for gonorrhœa ; the Madras Command, as usual, the highest ratio for secondary syphilis. In the Bengal Command the Rohilkhand District had the highest ratio for each form of venereal disease ; while in the Madras Command the Belgam District had the highest ratios for syphilis and for secondary syphilis.

More or less explanation of the prevalence of venereal disease, or of its increase or decrease, is attempted by some medical officers. With regard to the result of placing bazar and city out of bounds, the medical officers of Meean Meer, Calicut, Belgam, Poona, Colaba, Kurrachee, and Hyderabad, speak favourably ; those of Subathu, Campbellpur, and Kirkee, unfavourably ; while with regard to Satara the result is not mentioned.

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* Including men on field service.

Some medical officers consider that venereal disease and ague vary inversely to each other, ague diminishing virility.

The influence of the famine in increasing the number of prostitutes is noticed. At Deesa total abstainers were found to suffer more than others.

Sanitaria especially, but also other stations, returned cases which were really contracted before arrival.

The medical officers of Lucknow and Kirkee considered it probable that the cases returned as non-venereal buboes were mostly of venereal origin, though proof was wanting. The remarks of the medical officer at Calcutta on non-venereal buboes are to the same effect as those quoted in paragraph 30 of the report for 1896.

The subject of intramuscular injections of mercury is noticed in many reports, as well as continued peroral treatment in barracks, as a means of obtaining more thorough cures without losing the services of the men ; and the medical officer of Mhow points out the effect of this plan in reducing the number constantly sick in hospital, as well as the average duration of a case in hospital.

Statistics show clearly how the arrival year by year, especially since 1878, of fresh batches of young unmarried men under the short service system has been accompanied by an increase of venereal disease.

On the next page particulars are given regarding invaliding for venereal disease in relation to age and length of service.

The following table shows the admission rate for venereal disease as far back as the records for India as a whole permit. The heading " primary syphilis " includes the local sore throughout :—

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.
1872	61·2	22·4	179·0	1885	122·1	28·7	342·7*
1873	53·4	20·4	166·7	1886	157·9	33·3	389·5*
1874	68·3	25·2	192·7	1887	142·1	29·4	361·2*
1875	67·1	25·1	205·1	1888	142·1	32·4	370·6
1876	59·8	23·9	189·9	1889	225·1	51·2	481·5
1877	65·2	22·1	208·5	1890	220·7	66·3	503·5
1878	95·3	22·0	271·3	1891	159·2	60·0	400·7
1879	79·2	24·5	234·8	1892	161·1	57·8	409·9
1880	87·9	23·1	249·7	1893	213·6	61·6	466·0
1881	92·0	23·1	260·5	1894	248·1	74·6	511·4
1882	87·6	23·2	265·2	1895	239·0	84·9	522·3
1883	87·2	23·5	270·3	1896	226·4	97·7	511·6
1884	90·2	24·4	293·9	1897	201·7	101·9	485·7

* Including troops on active service in Burma.

The figures in the above table show a more or less continuous rise, especially since the end of 1884 ; and though there was a fall in the general ratios in 1896 and 1897, the rise in secondary syphilis continued uninterrupted, the ratio of 1897 being the highest on record.

Invaliding.—In the whole army of India 2,258 men were invalided, or 33·01 per 1,000 of strength, against 1,966 and 27·89 in the preceding year, the increase being partly due to the larger number of men invalided for secondary syphilis. The ratio for the decennium 1886–1895 was 24·34. The proportion of invalids to strength was lowest in the Punjab command, and highest in the Madras command.

—	1893.	1894.	1895.	1896.	1897.
India	39	39	33	39	34

Thirty-four per cent. of the total number invalided were discharged as unfit for further service. As shown above this percentage was somewhat, though not unprecedentedly,

low. It should be mentioned, however, that the question in the case of each soldier as to whether the disability necessitates discharge is revised in England by a medical board ; so that the Indian figures do not show the real final disposal of invalids.

The following shows the diseases which accounted for invaliding ratios of not less than 1 per 1,000 of strength :—

Invaliding Ratios per 1,000 of Strength.	—
Syphilis and gonorrhœa	9·65
Debility	2·62
Malarial fevers	2·41
Tubercle of the lungs	1·94
Valvular disease of the heart	1·30
Dysentery	1·17
Rheumatism	1·11
Disordered action of the heart	1·10

The ratio of invaliding from mental diseases rose from 1·05 per 1,000 in 1896 to 1·39 in 1897, and was above the decennial ratio (1·19). There were 50 cases of melancholia, 35 of dementia, 15 of mania, and 14 of other forms of insanity.

The percentage of men who were invalided while under 25 years of age to the whole number invalided was 63, against 62 in 1896. The percentage of men under 25 in the strength of the army was 55, against 56.

Of the total number of men invalided, 32 per cent. were of less than two years' service, and 85 per cent. were of less than five years' service. With this is to be considered the fact that 84 per cent. of all the men in the strength of the army were of less than five years' service.

With regard to individual diseases the highest invaliding ratio per 1,000 of strength from venereal disease was in the age-period 20—25, and the relative liability for that period was 40 per cent. ; the actual number invalided for veneral disease in the same age-period was 426 ; of 100 invalided in the same age-period 31 were due to venereal disease, a proportion the same as in the next age-period ; and of the total invalided for venereal disease at all ages 64 per cent. were in that same age-period. The residence-period 2—5 years, and especially the second half of the period, had the largest proportion of invaliding for venereal disease, whereas in 1896 it was more particularly the first-half of the period 1—3 years which was so distinguished.

Statistics of officers.

The vital statistics of officers shows that the death-rate for the British Army was 23·04, and that for the Indian Army 18·92, both higher than in the preceding year, because of the fighting that had to be done in 1897. The number of deaths from enteric fever was greater than in 1896 among both British and Indian officers. Enteric fever caused, as usual, more deaths among the British than among the Indian officers, apparently because Indian officers have to serve first with British regiments, and it is known that youthful and newly-arrived men are more liable to take the disease than others.

The invaliding and death-rates were higher than for men, the admission-rates lower. The admission-rates from ague and venereal disease, and the death-rates from enteric fever and hepatic abscess, were lower than among men. The chief causes of admission among officers were ague, simple continued fever, and remittent fever ; and among the diseases with raised admission rates were enteric fever, ague, remittent fever, simple continued fever, dysentery, and diarrhœa, the ratios from influenza, small-pox, and respiratory diseases being lessened. Enteric fever and cholera were the chief causes of death ; the ratios from heat-stroke, dysentery, and remittent fever being raised, and those from pneumonia, circulatory diseases, hepatic abscess, and cholera lowered.

There was not more than one case of cholera at any one station. There were 19 cases of enteric fever in the field forces, 11 in the Tirah force. The greatest numbers of cases

of enteric fever were five at Lucknow and at Quetta and four at Agra. "The five admissions at Quetta occurred among the single officers of the 2nd Battalion, Lancashire Fusiliers. The cause was most probably the very insanitary condition of the mess kitchen. All the cases occurred within a very short time of one another."

On the whole the health of the women was better than in 1896, the chief feature of the following figures for 1897 being the decided fall in the death-rate :— Statistics of women.

Period.	Average annual strength.	Admission-rate per 1,000.	Constantly sick-rate per 1,000.	Death-rate per 1,000.
1886–95	31,881	815·2	32·1	17·00
1896	3,254	807·0	37·4	18·44
1897	3,203	768·3	38·2	15·30

The chief causes of admission were debility, ague, and the diseases peculiar to women. Among diseases which caused increased admission were cholera, ague, tubercle of the lungs, and dysentery; while from influenza, small-pox, respiratory diseases, and enteric fever, admission was lessened. Debility caused nearly 35 per cent. of the total sickness, and ague over 21 per cent.

The chief causes of death were puerperal affections and tubercle of the lungs. Among the diseases which gave increased mortality were cholera, dysentery, pneumonia, remittent fever, and puerperal affections. Mortality from enteric fever, respiratory diseases other than pneumonia, diarrhœa, hepatic abscess, and small-pox, was diminished. Puerperal diseases caused 10 per cent. of the total deaths, and tubercle of the lungs 8 per cent. There were only two cases of cholera among the women.

That the health of the children was worse than in 1896 may be seen in the following table :— Statistics of children.

Period.	Average annual strength.	Admission-rate per 1,000	Constantly sick-rate per 1,000.	Death-rate per 1,000.
1886–95	59,695	581·8	22·7	46·72
1896	5,790	573·6	24·9	45·60
1897	5,744	572·1	26·7	50·49

The chief causes of admission were ague and respiratory diseases. Among the diseases with raised admission-rates were influenza, cholera, remittent fever, eye diseases, ague, and bowel complaints; while admission from small-pox, whooping cough, and measles was lessened. Ague caused nearly 19 per cent. of the total sickness, and respiratory diseases nearly 12 per cent.

The chief causes of death were teething, diarrhœa, debility (including immaturity at birth) respiratory diseases, and convulsions. Among the diseases from which there was increased mortality were cholera, tubercle, ague, respiratory diseases, teething, debility, and bowel complaints. Mortality from small-pox, diphtheria and croup, enteric fever, convulsions, and remittent fever, was diminished. Teething and diarrhœa caused each over 15 per cent. of the total deaths, debility 13 per cent., and respiratory diseases 10 per cent.

Native Troops.

Sickness and mortality in 1897.

Though influenza and cholera were less prevalent, yet, owing to the arrival of an abundant monsoon after a prolonged period of drought, there was an increase of malaria, and therefore of sickness and mortality, in 1897 as compared with 1896. The sickness and mortality were also raised by the employment of a large body of men on active service :—

Year.	Average strength.	Ratio per 1,000.							
		Admissions into hospital.	Constantly sick.	Deaths from					Mortality, including absent deaths.
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.	
1886–95 ...	123,302	976	34	1·32	1·34	3·02	·78	12·43	16·72
1896	128,286	763	29	·69	1·07	3·14	·42	10·20	12·57
1897	129,802	839	31	·52	1·04	2·73	·67	13·12	14·90

The chief causes of admission were ague and dysentery. Among the diseases with raised admission rates were enteric fever, dysentery, and ague. Among those with lessened rates were influenza, small-pox, scurvy, cholera, and respiratory diseases. Ague caused 41 per cent. of the total admissions.

The chief causes of death were pneumonia and remittent fever. Among the diseases which caused increased mortality were enteric fever, ague, and bowel complaints. Among those from which mortality was lessened were small-pox, cholera, remittent fever, respiratory diseases, and debility. Pneumonia caused 21 per cent. of the total deaths, and remittent fever 8 per cent.

The total number invalided for discharge was 1,649, and the chief causes of invaliding were debility, respiratory diseases, malarial fevers and venereal diseases.

If the following table be compared with that on page 42 it will be seen that the native soldier suffered less from cholera, enteric fever, ague, remittent fever, simple continued fever, tubercle of the lungs, diarrhœa, hepatitic affections, and venereal diseases ; equally from small-pox ; and more from influenza, respiratory diseases, dysentery, and scurvy, than his European comrade. These relations are usual, except with regard to cholera, ague, remittent fever, and small-pox.

Ratios of Commands.

—	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
I.—Average Annual Strength	26,644	35,454	23,588	26,421	6,554	129,802
II.—Constantly Sick-rate...	33·1	30·6	32·3	27·4	19·3	31·5
III.—Admission-rate of the Year :						
Influenza	3·1	·1	1·3	17·4	18·2	5·4
Cholera	·4	—	2·3	·9	2·7	·8
Small-pox	·6	·6	·3	·4	—	·4
Enteric fever	·3	·9	·1	·2	—	·4
Intermittent fever	363·9	400·8	214·7	329·2	226·3	346·9
Remittent fever	13·2	23·7	7·1	16·4	13·1	15·9
Simple continued fever	9·0	5·3	20·7	10·2	2·6	9·3
Tubercle of the lungs	4·1	3·7	2·0	1·2	1·7	2·6
Pneumonia	11·7	18·0	5·5	11·5	6·9	13·0
Other respiratory diseases	19·5	29·1	23·1	29·3	8·2	24·9
Dysentery	53·1	55·2	35·0	42·8	46·5	66·4
Diarrhœa	7·9	11·3	8·0	12·5	1·5	14·0
Hepatic abscess	—	—	·1	·2	·2	·1
„ congestion and inflammation ...	1·7	·6	1·4	1·4	1·1	1·2
Scurvy	·8	2·7	·5	4·4	9·5	2·8
Venereal diseases	54·9	31·8	48·4	44·6	23·2	40·8
All Causes	833·8	867·4	710·1	821·6	551·3	838·5

* Including those Imperial Service Troops that went on Field Service.

Ratios of Commands—continued.

	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
IV.—Death-rate of the Year:						
Cholera	·26	—	1·57	·57	1·37	·52
Small-pox	·11	·06	—	·03	—	·05
Enteric fever	·11	·28	—	·08	—	·12
Intermittent fever	·79	·45	·34	·34	·61	·65
Remittent fever	·86	1·47	·76	·79	·76	1·04
Simple continued fever	·04	·03	·04	·03	—	·03
Circulatory diseases	·23	·11	·55	·38	·15	·27
Tubercle of the lungs	1·46	1·24	·38	·26	·31	·79
Pneumonia	1·80	4·29	1·14	2·35	·61	2·73
Other respiratory diseases	·49	·54	·30	·49	·31	·50
Dysentery	·41	·45	·25	·49	·46	·67
Diarrhœa	·11	·11	·04	·15	—	·17
Hepatic abscess	—	·03	·04	·19	·15	·06
Anæmia and debility	·11	·06	·21	·15	·15	·17
All Causes	9·12	13·26	9·45	10·48	6·26	13,12

* Including those Imperial Service Troops that went on Field Service.

Of the commands the Punjab was the most unhealthy, and it was slightly more unhealthy than in the previous year. Its death ratios from enteric fever, diarrhœa, tubercle of the lungs, and dysentery, were raised, while those from small-pox, respiratory diseases, and cholera, were lowered. Bengal had the highest constantly sick rate, the Punjab the highest admission and death-rates. The highest ratios of mortality from small-pox, ague, and tubercle of the lungs were in Bengal; the highest from enteric fever, remittent fever, pneumonia, and other respiratory diseases in the Punjab; the highest from cholera in Madras; and the highest from dysentery and diarrhœa in Bombay.

The following table shows the statistics of all the native troops serving in Burma and the Andamans. Of these troops in 1897, about 98 per cent. belonged to the Madras Army:—

Years.	Average annual strength present.	Ratio per 1,000.						
		Admissions into hospital.	Constantly sick.	Deaths from				
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.
1891	11,401	1,676	76	1·75	2·98	1·84	4·03	36·31
1892	11,333	1,349	57	2·29	2·29	2·29	3·09	29·12
1893	10,326	1,092	48	·87	1·45	2·42	1·36	19·85
1894	10,500	809	35	1·43	·95	1·14	1·43	13·90
1895	9,952	827	37	·80	·50	·80	·80	10·55
1896	9,605	830	38	—	·94	·73	1·35	9·58
1897	8,661	802	35	·46	·46	·92	·23	6·58

The table shows that the death-rate has been reduced year by year. Sickness was lower than in 1896. A comparison of the health of the troops in the Burma Coast group

of stations with that of the troops in the Burma Inland group may be made by the use of the following table :—

Ratios of Geographical Groups.

	Ratio per 1,000 of the Average Strength.												
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
	Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Army of India.*
I.—Average Annual Strength	2,215	5,354	1,791	3,059	6,295	14,704	15,270	12,203	19,137	2,808	8,229	20,430	129,802
II.—Constantly-sick Rate of the Year.	28·6	37·0	44·7	38·1	26·9	26·7	34·6	28·3	26·2	31·7	33·0	37·1	31·5
III.—Admission-Rate of the Year:													
Influenza	—	3·4	—	·7	10·6	·7	·1	1·4	6·3	16·7	1·3	19·6	5·4
Cholera..	·9	·2	—	—	·8	—	—	1·2	2·6	·7	3·5	·1	·8
Small-pox	·5	—	—	·3	1·0	1·4	·5	·2	·5	—	·4	·1	·4
Enteric fever	—	·2	2·2	—	·5	—	—	·2	·2	—	·1	1·6	·4
Intermittent fever .. —	94·8	328·2	477·9	408·3	205·6	295·4	616·0	318·9	287·9	112·5	118·7	412·5	346·9
Remittent fever	·9	9·0	21·8	4·9	16·4	20·9	13·2	9·2	13·3	49·9	5·0	28·3	15·9
Simple continued fever ..	·9	13·1	12·3	10·5	1·6	3·1	11·7	16·8	8·7	20·7	26·0	3·1	9·3
Tubercle of the lungs ..	1·4	2·4	3·4	2·0	3·5	4·6	3·7	1·1	1·6	2·8	1·1	4·4	2·6
Pneumonia	4·1	4·9	10·6	5·2	11·3	11·2	26·9	13·3	7·2	2·5	5·3	15·9	13·0
Other respiratory diseases	29·3	27·8	25·1	29·4	17·5	19·0	37·1	21·8	12·4	28·8	22·6	37·2	24·9
Dysentery	91·1	24·5	107·8	60·5	50·4	27·2	78·0	39·6	45·9	69·8	28·6	49·6	66·4
Diarrhœa	19·4	9·2	21·8	3·9	7·0	6·1	13·2	8·1	6·3	13·9	6·2	14·8	14·0
Hepatic abscess	—	·2	—	—	—	·1	—	—	·1	·4	·1	·1	·1
„ congestion and inflammation.	—	1·7	5·6	2·3	1·6	·8	·5	1·0	1·5	1·8	1·9	1·3	1·2
Scurvy	—	·2	1·1	1·3	·2	1·4	3·5	3·0	4·3	1·4	—	4·5	2·8
Venereal diseases	33·4	52·9	97·2	40·5	51·5	36·0	24·4	49·9	47·0	75·4	44·0	47·7	40·8
All Causes ..	690·3	784·1	1,065·9	934·6	618·1	697·0	1,132·1	783·9	728·5	760·0	611·7	973·4	838·5
IV.—Death-Rate of the Year:													
Cholera	·45	·19	—	—	·48	—	—	·66	1·67	—	2·31	·10	·52
Small-pox	—	—	—	—	—	·14	·13	·08	—	—	—	·05	·05
Enteric fever	—	—	1·12	—	·16	—	—	·16	—	—	—	·49	·12
Intermittent fever	—	1·31	1·12	1·96	·64	·41	·46	·25	·37	—	·12	·59	·65
Remittent fever	·45	·56	·56	·33	·95	1·29	·92	·90	1·05	1·07	·85	1·52	1·04
Simple continued fever ..	—	—	—	·33	—	·07	—	·08	—	—	·12	—	·03
Circulatory diseases ..	·45	·19	—	—	—	·07	·07	·66	·57	—	·73	·15	·27
Tubercle of the lungs ..	—	·37	1·12	·65	·79	1·36	·79	·25	·37	1·07	·36	1·91	·79
Pneumonia	·45	1·12	1·68	·98	2·70	2·38	7·14	1·97	1·41	·36	1·46	2·55	2·73
Other respiratory diseases	—	·37	—	—	·48	·61	·72	·49	·31	·71	·36	·54	·50
Dysentery	·45	·19	1·68	·65	·32	—	·85	·33	·42	·36	·24	·49	·67
Diarrhœa	—	—	—	—	·16	·20	·13	—	·10	—	—	·10	·17
Hepatic abscess	—	·19	—	—	—	·07	—	—	·10	·36	—	·15	·06
Anæmia and debility ..	—	·19	1·12	—	·16	·07	—	—	·31	—	·24	·05	·17
All Causes ..	4·51	7·47	12·84	6·21	9·53	8·43	13·56	7·38	12·75	8·55	9·36	14·39	13·12

* Including Group Extra-India.

The following statistics are those of the regiments stationed beyond the North West Frontier and in Baluchistan. The garrisons of Gilgit, Chitral, and the Malakand are not included :—

Year.	Average annual strength present.	Ratio per 1,000.						
		Admissions into hospital.	Constantly sick.	Deaths from				
				Cholera.	Remittent fever.	Pneumonia.	Dysentery.	All causes.
1897	9,188	1,182	34	—	·76	3·92	·65	15·35

If this table be compared with that for India on page 64, it will be seen that the statistics of the trans-frontier troops were considerably less favourable than those of India as a whole, a high death-rate from pneumonia being a salient feature.

Of the garrisons of Gilgit, Chitral, and the Malakand, Chitral was the most unhealthy, and the Malakand the least so.

Of the forces which took the field in 1897, wounds and violent deaths were most frequent in the Tirah force, which was constantly on the move and fighting ; but in the Tochi force, whose chief duty was to wait in an unhealthy valley, disease was most prevalent.

The table which follows shows that both for the decennium and in 1897, Groups II, III, and IV had high constantly sick ratios ; and that both for the decennium and in 1897 mortality from respiratory diseases was greatest in the Indus Valley. Cholera mortality was below the decennial figure in all the groups except Burma Coast, Deccan, and Southern India :—

		Ratio per 1,000 of Strength.											
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
		Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia-Nagpur.	Upper Sub-Himalayan.	N. W. Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	India.
1886-1895.	Constantly-sick rate...	48·9	65·8	62·8	48·2	28·9	31·6	37·1	27·6	28·3	23·4	26·2	42·3	33·6
	Death-rates from—													
	Cholera	—	4·47	·70	·59	1·14	·82	·80	·69	·87	·14	1·31	1·29	1·32
	Respiratory diseases	1·43	2·35	2·43	1·25	1·57	4·56	6·79	2·69	1·60	1·08	1·56	6·43	3·60
1896.	Constantly-sick rate...	19·6	45·9	44·5	36·1	24·8	24·2	27·4	26·0	26·2	27·3	28·5	38·6	28·6
	Death-rates from—													
	Cholera	—	—	14·09	·64	·29	·56	·07	·98	·98	—	1·37	—	·69
	Respiratory diseases	·43	1·05	·56	2·57	·59	4·70	10·49	3·26	2·84	1·10	1·49	3·87	3·72
1897.	Constantly-sick rate...	28·6	37·0	44·7	38·1	26·9	26·7	34·6	28·3	26·2	31·7	33·0	37·1	31·5
	Death-rates from—													
	Cholera	·45	·19	—	—	·48	—	—	·66	1·67	—	2·31	·10	·52
	Respiratory diseases	·45	1·49	1·68	·98	3·18	2·99	7·86	2·46	1·72	1·07	1·82	3·09	32·3

In the Table on page 66, it may be seen that Assam had the highest admission ratios from enteric fever, dysentery, diarrhœa, hepatic congestion, and venereal diseases ; the Upper Sub-Himalayan group the highest from small-pox and tubercle ; the Indus Valley

the highest from ague and pneumonia, and nearly the highest from other respiratory diseases ; the Western Coast the highest from remittent fever and abscess of the liver ; Southern India the highest from cholera and simple continued fever ; and the Hills the highest from influenza, respiratory diseases other than pneumonia, and scurvy. The hill station of most influenza was Quetta. The presence of enteric fever and the prevalence of venereal disease in Assam are due to the number of Gurkha troops there.

Of the large stations throughout India with a strength of not less than 1,000, the following returned the highest death-rates :—Belgam 34·31, Dharmsala 25·60, Edwardesabad 24·78, Poona 21·05, Dehra Dun 20·75. The principal cause of death at Belgam and Poona was plague, at Edwardesabad pneumonia, at Dharmsala remittent fever, and at Dehra Dun tubercle of the lungs.

As quoted by the medical officer of the 10th Bombay Light Infantry, the finding of a board of medical officers assembled at Aden, by order of the general officer commanding, on the 4th November 1897 "to inquire into the causes of scurvy, fever, and dysentery, "prevalent among the native troops," was as follows :—

"That fever (including under that name intermittent, remittent, and simple continued fevers) is "very prevalent in Aden, and they are of opinion that it is due to persistent malaria, acting on con- "stitutions already weakened by indifferent food and insufficient vegetables, together with a certain "amount of nervous prostration produced by the long continued damp relaxing climate of the place. "Under the head of scurvy comparatively few cases are admitted, but there can be no doubt what- "ever that many of the cases of bowel complaints, including dysentery, for which the admissions are "usually much in excess of the average for the whole of India, are complicated by, if not primarily "induced from, a scorbutic state of the constitution. The board are of opinion that these conditions "are permanent, and that a regiment suffers materially in health, physique, and general stamina by "prolonged residence in this place, where malaria is always present (there is no marked malarial "season, as in India generally), and where the want of fresh vegetable food and good water is severely "felt.

"With regard to the last remark concerning water, they desire to point out that all the water used "for drinking purposes is distilled from sea-water, and consequently has but little vitality or freshness "in it, a condition which tends to produce dyspepsia, or a flaccid, inert condition of the digestive "system, leading to a state very appropriate for the setting up of bowel complaints, and this may "have no small effect on the excessive number of cases admitted under the head of dysentery.

"On the whole, the board are of opinion that nothing but harm is likely to result from the retention "of a regiment in Aden for a longer period than two years."

Principal Diseases: Influenza.—Attention having been directed to the health statistics of India, of the commands, of the geographical groups, of stations, and of regiments, it will be convenient now to consider some of the chief diseases. Influenza decreased much, there having been 695 cases, 5·4 per 1,000 of strength, against 1,369 cases, 10·7 per 1,000 of strength, in the preceding year. This number of admissions for 1897 is the lowest that has been returned since the disease first invaded India in 1890. The geographical groups affected both in 1896 and in 1897 were II, IV, V, VI, VII, VIII, IX, XI, XII ; III was affected in 1896, not in 1897, X in 1897 not in 1896 ; while I has had no case since 1892. In proportion to strength the Hills group was, as in the previous year, most severely affected ; and the greatest number of cases also occurred in that group. The following table shows the monthly progress of the disease since its beginning in 1890. The maximum month varied from year to year, but over the period as a whole most cases occurred in April and March, and fewest in October and September :—

Years.	Number of Admissions into Hospital each month.												Total.	Admitted per 1,000 of Strength.	Died per 1,000 of Strength.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.			
1890 ...	1	8	2,460	5,118	492	82	55	—	—	—	1	—	8,217	64·3	·41
1891 ...	—	—	1	—	105	259	123	106	51	22	17	215	899	7·0	·09
1892 ...	681	371	511	149	40	5	5	7	—	1	7	18	1,795	14·1	·15
1893 ...	8	28	65	99	95	13	9	7	—	3	53	404	784	6·2	·20
1894 ...	159	203	232	384	143	11	5	—	1	1	5	11	1,155	9·0	·16
1895 ...	26	28	53	76	110	25	60	57	19	17	31	·408	910	7·0	·08
1896 ...	372	196	397	35	22	11	33	57	53	39	82	72	1,369	10·7	·30
1897 ...	97	61	100	117	84	79	22	—	42	67	23	3	695	5·4	·04
Total	1,344	895	3,819	5,978	1,091	485	312	234	166	150	219	1,131	15,824	15·4	·18

The greatest number of cases occurred at Quetta, Bolarum, and Lucknow. At the first named station the disease was present during the first seven months of the year; while at Bolarum it was confined to March, April, and May and at Lucknow to the last quarter of the year. The following table shows that in 1897 the native troops, though somewhat more severely affected than the European troops, were, as usual, considerably less severely affected than the prisoners :—

Years.	Per 1,000 of Average Strength.											
	Influenza.						Pneumonia.					
	European Troops.		Native Troops.		Prisoners.		European Troops.		Native Troops.		Prisoners.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1890	33·4	·03	64·3	·41	78·6	·67	4·6	·90	16·7	3·96	18·5	5·71
1891	5·5	·04	7·0	·09	19·0	·29	2·6	·54	11·6	2·53	17·0	4·87
1892	12·7	·01	14·1	·15	56·7	1·26	3·5	·62	13·6	3·26	18·4	5·56
1893	·3	—	6·2	·20	6·4	·09	3·4	·70	12·3	2·75	15·9	3·95
1894	3·4	·01	9·0	·16	41·0	·43	3·7	·75	12·9	2·87	15·4	4·31
1895	7·8	·03	7·0	·08	20·3	·15	4·4	·51	17·5	4·20	16·4	4·00
1896	11·5	·11	10·7	·30	37·6	·60	5·2	·64	15·3	3·14	19·1	4·34
1897	4·0	·01	5·4	·04	8·4	·21	3·4	·60	13·0	2·73	15·6	4·24

It also shows the relation of the pneumonia death-rate year by year to the admission rate from influenza. Of course, the presence or absence of influenza is not the only circumstance which influences the pneumonia death-rate. Another powerful factor is the occurrence or non-occurrence in the year of exposure on field service.

Cholera.—There were 109 cases of cholera with 68 deaths, against 132 cases with 88 deaths in the preceding year. The admission-rate was 0·8 per 1,000 against 1·0, and the death-rate 0·52 against 0·69. Cases occurred in every month except December, the maximum months being July and August. The greatest number of cases occurred in the Deccan and Southern India. Among stations Secunderabad and Bellary had most cases, 15 and 12 respectively ; the other stations affected having less than a dozen, and most of them less than half-a-dozen, each. The regiment chiefly affected at Bellary was the 1st Madras Lancers, and the disease broke out in a bazar adjoining the regimental lines. Cholera was also found to be present in a village near the first camping ground, and the medical officer of the regiment contracted a fatal attack while looking up the cases in the village. The next camp-movement stopped the disease.

Small-pox.—There were 53 cases of small-pox with 6 deaths, against 148 cases with 13 deaths in the preceding year. The admission ratio was 0·4 per 1,000 against 1·2, and the death ratio 0·05 against 0·10. In the Upper Sub-Himalayan group the cases bore the highest proportion to strength. The greatest number of cases occurred in Upper Sub-Himalayan, Deccan, and Indus Valley groups. Among stations Meean Meer had 10 cases, the highest number at any one station ; and no regiment had more than three cases, except the 32nd Pioneers, which had seven.

Ague, Remittent Fever, Simple Continued Fever.—To ague was due over 41 per cent. of the sickness of the native army. Owing, no doubt, to the abundant rainfall following drought, the admission rate from ague rose very considerably in 1897, from 276·2 to

346·9 per 1,000. The Indus Valley was the most malarious group, and the Burma Coast, as in the previous year, the least malarious ; and the most malarious months were October and November, and the least malarious month February. Remittent fever caused 8 per cent. of the total deaths, and prevailed most in August, June, November, and September. The proportion of cases returned as simple continued fever is much lower in the native army than in the European ; but it is pretty certain that many cases which in the latter would be so returned are in the former called ague. The simple continued fever of the native army was high in March, but fell again, began to increase once more in June, and reached its maximum in October. This was quite different from its distribution in the preceding year.

Enteric Fever.—The ratio of admission from enteric fever in the native army in 1897 was 0·4 per 1,000 of strength, and the death-rate 0·12, against 0·1 and 0·04 in the previous year. The corresponding decennial ratios of 1886—95 are 0·2 and 0·08. The following table shows that the ratios for European troops are very unlike those for native troops and prisoners :—

	1886–95.		1897.	
	Admissions.	Deaths.	Admissions.	Deaths.
European troops	19·6	5·28	32·4	9·01
Native troops	·2	·08	·4	·12
Jail population	·3	·12	·3	·13

The next table indicates the fact that the total fever mortality in the two armies is not the same in amount, which indicates that the difference is not altogether a mere matter of diagnosis :—

Causes of Death.	Died per 1,000 of Average Strength.		Relative Liability in Percentages.			Percentage in Deaths from all causes.	
	European Troops.	Native Troops.	European Troops.	Native Troops.	Total = 100.	European Troops.	Native Troops.
Ague	·41	·65	39	61	100	1·8	5·0
Remittent fever	·60	1·04	37	63	100	2·6	7·9
Simple continued fever	·01	·03	25	75	100	·1	·2
Enteric fever	9·01	·12	99	1	100	39·3	·9
Total	10·03	1·84	84	16	100	43·8	14·0

The total fever mortality among the native troops in 1897 was to the total fever mortality among European troops as 1 : 5·5. For the period 1886—95 the corresponding ratio was 1 : 2·6, and for 1896 it was 1 : 4·2. Again, among the European troops 44 per cent. of all deaths in 1897 were from fevers ; only 14 per cent. among native troops. As the death-rate of European troops from enteric fever in 1897 was nearly five times as great as that of native troops from all kinds of fever, it appears, whatever may be the nature of the remittent and continued fevers from which native soldiers died, that native soldiers and prisoners were less liable to enteric fever than European soldiers.

The question of the immunity, or apparent immunity, of natives of India as regards enteric fever, has been frequently discussed in former reports. On page 71 of the report for 1896 were noticed the assertion that the blood of natives of India over the age of early childhood re-acted to Widal's test, and the conclusion therefrom drawn that the majority

of adult natives had passed through enteric fever ; and it was there shown that this had by no means been proved. It seems that a similar assertion had been made regarding the blood of negroes in America, and that the accuracy of the observation is now denied.

A few more observations have been published regarding the relation of the darker-skinned races to enteric fever. In Algeria the native Arabs are said to be a hundred times less liable to enteric fever than the French soldiers. One of the medical officers who write in the special medical part of the report of the Chinese Imperial Maritime Customs is of opinion that characteristic enteric fever sometimes occurs among the natives of China, while one states that he has never seen a pure case among them. On the other hand, the Japanese soldiers appear to have suffered from the disease during the late war between China and Japan, 131 cases and 24 deaths having been officially recorded. It has been reported that enteric fever is common in Bombay, but that among natives bowel symptoms are but slightly marked and the disease is not so fatal. It is, however, a fact that year after year Bombay exhibits a comparative rarity of enteric fever in its European garrison, and that for at least three years no cases have been returned from its native garrison. A good deal more must be scientifically known about the natives of malarious countries before the statement that they are less liable than others to enteric fever can be critically considered. Even if there be some references to this point in Italian medical literature, it is not certain that the conclusions arrived at would hold good for darker races.

In the whole native army of India, 51 cases with 15 deaths were returned as enteric fever, as against 19 cases with 5 deaths. In only three cases were *post-mortems* obtained ; and the lesions described support, or do not contradict, the diagnosis. The greatest numbers of cases occurred at Kila Drosh (Chitral), Wana, and Manipur.

Plague.—In 1896 there were two cases of plague with one death ; in 1897, one hundred and thirty-one cases with eighty-two deaths.

Respiratory Diseases.—Both morbidity and mortality from respiratory diseases were less than in 1896, and were also unusually low :

Period.	Ratio per 1,000 of Strength.			
	Respiratory Diseases.		Pneumonia.	
	Admissions.	Deaths.	Admissions.	Deaths.
1886–95	50	3·75	13	3·02
1896	43	3·72	15	3·14
1897	38	3·23	13	2·73

Respiratory diseases are the chief cause of death in the native army, and in 1897 over 24 per cent. of all deaths were due to them. For respiratory diseases other than pneumonia the highest admission ratios were those of the Hills and the Indus Valley, and the lowest that of the Deccan. Of commands the Punjab had the highest death-rate, and Madras the lowest.

Pneumonia.—The admission and death ratios from pneumonia, as may be seen from the table given in the preceding paragraph, fell considerably ; and were no longer, as in 1896, above the decennial ratios. In the table on page 69 is displayed the relation from year to year between pneumonia and influenza. The admission ratio was highest, as usual, in the Indus Valley ; and in the death-rate the Indus Valley thoroughly maintained its primacy. Both in the Indus Valley and in the Hills, pneumonia was most prevalent in the cold months, and the same was the case for India as a whole.

Dysentery and Diarrhœa.—From dysentery the admission-rate was much, and the death-rate considerably, higher than in the preceding year. The highest admission ratios were

in the Punjab command and the Assam group ; the highest death-rates in the Bombay command and the Assam group. The reason why the ratios of India are higher than those of any of the commands is that under the head of India is included field service, and field service gave rise to much dysentery. The death-rate of native troops from dysentery was to that of European troops as 1 : 3·8 ; and the percentage of dysentery in total cases of death was 5·1 in the case of native troops, and 11·0 in the case of European troops. Again, the case mortality of native troops was 1·00 per cent., while that of European troops was 5·32. The admission rate of native troops was, however, as in the previous year, much higher than that of European troops, 66·4 to 45·7.

The admission and death ratios from diarrhœa also rose in the year under review.

Venereal Diseases.—The following table is given to compare with the corresponding one for European troops on page 61.

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.
1877	11·5	5·3	26·7	1888	13·5	5·4	31·5
1878	16·3	5·8	37·5	1889	16·6	6·4	38·9
1879	16·5	7·0	37·1	1890	16·0	6·9	41·1
1880	15·0	5·8	33·3	1891	13·6	6·9	37·9
1881	17·9	7·2	39·5	1892	14·1	7·9	39·6
1882	14·7	5·9	34·4	1893	13·3	9·0	36·4
1883	13·0	6·5	31·6	1894	13·8	8·2	32·3
1884	11·0	5·3	27·9	1895	13·1	7·3	31·3
1885	11·2	5·9	30·1	1896	15·5	8·9	37·2
1886	13·7	6·0	28·1	1897	16·1	9·0	40·8
1887	12·6	6·1	27·4				

The figures for India are not available for the years before 1877. All the venereal ratios of native troops run at a much lower level than those of European troops ; and they have remained comparatively steady during the years of which the statistics are given.

A comparison of Tables on pages 42 and 64, will show that, leaving the Hyderabad Contingent out of account, the lowest ratios for both European and native troops were those of the Punjab Command, and the highest those of the Bengal Command. In all the commands the ratios of native troops were much lower than those of European troops.

Whilst among the European troops an average strength of 68,395 gave 33,219 admissions, in the case of native troops an average strength of 129,802 gave only 5,295 admissions. In other words, there were only 41 admissions for every 1,000 men among native troops, against 486 for every 1,000 men among European troops.

The admission rate was 3·7 per 1,000 more than in 1896. There were 12 deaths and 106 invalidings directly due to veneral disease. In 25 out of 184 stations the admission rate from secondary syphilis was over 20 per 1,000 of strength, and in 36 it was over 10 per 1,000.

Beri-Beri. Strongylus Duodenalis.—Of the 137 cases returned as beri-beri, 135 occurred in Madras regiments, especially the 20th, the 19th, and the 9th infantry regiments. The Madras command accounted for 18 out of the 20 deaths ; 3 in Burma and 15 in the peninsular part of the command. A considerable amount of doubt still attaches to the diagnosis of these Indian cases.

Jails.

Sickness and mortality in 1897.

The drought, with resulting famine, continued into the first-half of 1897 from 1896, and was followed by a retarded but copious and well-distributed monsoon. In the period of drought cholera was prevalent here and there; while after the onset of the rains cholera, malaria, and dysentery attacked the people weakened by want of food, and found them an easy prey. Naturally, the health statistics of prisoners, and especially the death-rate, were unfavourably affected:—

Year.	Average strength.	Ratio per 1,000.									
		Admissions into Hospital.	Constantly Sick.	Deaths from							
				Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
1886–95 *	960,973	1,097	39	2·74	1·49	6·80	2·82	5·85	2·50	2·52	32·20
1896 * ...	110,186	983	41	1·27	1·07	5·91	1·98	5·27	3·08	1·42	27·68
1897 * ...	118,107	1,045	41	3·94	1·08	11·07	3·17	5·19	3·02	2·35	38·75

* Excluding subsidiary jails.

The chief causes of admission to hospital were ague, dysentery, abscess, &c., and diarrhœa. Among the diseases with raised admission rates were cholera, ague, scurvy, debility and dysentery; while the rates from influenza, remittent fever, simple continued fever, tubercle of the lungs, and respiratory diseases were lowered. Ague caused 36 per cent. of the total sickness, and bowel complaints 17 per cent.

The chief causes of death were dysentery, pneumonia, cholera, and diarrhœa. Among the diseases with increased mortality were cholera, dysentery, enteric fever, debility, diarrhœa and gangrene. Among those with lessened mortality were tubercle of the lungs and pneumonia. Dysentery caused 29 per cent. of the total deaths, pneumonia 11 per cent., and cholera 10 per cent.

The following statement shows for each administration, except the Andamans, the proportion of prisoners in 10,000 of the population. Some of the prisoners of each province have been transported to the Andamans, though in the case of Bombay such transportation was restricted on account of plague; and these are necessarily excluded from the calculations, so that the ratios are all somewhat too low:—

Administrations.	Period.	General Population according to Census of 1891.	Prisoners.		
			Average Number.*	Proportion per 10,000 of Population.	Deaths per 1,000 of Average Strength.*
Burma	1896	7,605,560	14,460	19·0	18·19
	1897		13,435	17·7	24·12
Assam	1896	5,476,833	1,534	2·8	50·85
	1897		1,500	2·7	48·67
Bengal	1896	71,346,987	17,495	2·5	28·64
	1897		19,548	2·7	35·04
North-Western Provinces and Oudh.	1896	46,905,085	32,984	7·0	28·83
	1897		36,254	7·7	35·44
Punjab	1896	20,866,847	12,021	5·8	15·64
	1897		12,968	6·2	16·19
Bombay	1896	18,901,123	8,256	4·4	31·98
	1897		9,385	5·0	35·38
Berar and Secunderabad	1896	2,897,491	1,432	4·9	25·14
	1897		1,898	6·6	34·77
Central Provinces ...	1896	10,784,294	5,583	5·2	72·36
	1897		7,401	6·9	134·98
Madras	1896	35,630,440	9,584	2·7	19·51
	1897		10,312	2·9	47·32

* Including subsidiary jails.

The following table compares the ten administrations with each other and the present of each administration with its past :—

—	Year.	Average Strength.	Ratio per 1,000.*									
			Admissions.	Constantly Sick.	Deaths from							
					Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
Andamans	1886–95	114,148	1,743	57	—	4·50	7·94	2·66	3·93	3·88	3·14	33·89
	1896	10,520	1,350	46	—	2·19	6·08	1·43	2·28	3·80	1·43	23·29
	1897	10,590	1,674	50	—	2·83	9·35	1·13	3·12	4·53	1·13	27·20
Burma	1886–95	110,408	939	43	6·04	1·32	7·92	2·32	3·60	3·12	2·00	36·56
	1896	14,460	759	35	·55	·62	2·97	·83	2·77	4·50	·28	18·19
	1897	13,435	596	29	5·21	·52	5·21	1·71	2·23	2·46	·52	24·12
Assam	1886–95	11,550	1,758	58	5·19	1·99	14·37	7·71	5·54	1·30	4·42	52·90
	1896	1,273	1,034	53	1·57	3·14	13·35	6·28	5·50	3·14	6·28	56·56
	1897	1,233	1,028	52	5·68	·81	9·73	4·06	3·24	—	2·43	46·23
Bengal	1886–95	150,931	1,180	41	3·70	1·46	10·42	2·90	4·54	3·35	1·58	36·06
	1896	16,542	1,221	40	3·75	1·57	7·38	1·15	3·32	3·14	1·27	29·20
	1897	18,343	1,045	37	3·27	·87	10·47	1·96	4·47	3·43	·87	34·24
N.-W. P. and Oudh.	1886–95	251,465	792	37	1·70	·65	5·60	2·40	6·02	1·96	2·06	27·54
	1896	32,830	892	51	·49	·73	4·75	2·38	7·74	2·47	2·50	28·82
	1897	35,890	1 012	50	1·28	·53	9·17	3·15	6·07	2·48	4·07	35·44
Punjab	1886–95	115,378	1,667	38	1·59	1·18	3·90	2·21	11·42	2·10	·61	30·23
	1896	11,894	1,234	31	—	·67	1·68	·67	4·29	1·85	·17	15·64
	1897	12,785	1,336	31	—	1·02	2·66	1·17	5·00	2·11	·63	16·35
Bombay	1886–95	68,265	757	28	1·48	1·74	3·56	3·56	9·10	1·74	2·12	30·18
	1896	7,092	895	35	3·67	1·97	3·24	2·82	9·87	2·26	·85	33·56
	1897	7,767	846	29	5·28	3·22	3·22	3·60	8·75	2·96	·51	37·21
Berar and Secunderabad.	1886–95	11,539	756	22	·69	·95	2·08	1·13	5·46	1·13	·95	20·11
	1896	1,432	594	18	1·40	—	·70	·70	7·68	·70	4·89	25·14
	1897	1,898	551	17	·53	·53	6·32	1·58	6·84	1·58	4·21	34·77
Central Provinces.	1886–95	43,798	936	31	4·73	1·21	11·39	5·23	5·75	1·94	3·36	42·65
	1896	5,583	1,112	41	3·94	1·79	32·60	10·21	8·06	5·37	2·15	72·36
	1897	7,401	1,233	65	4·19	1·49	64·72	18·65	10·13	4·86	9·73	134·98
Madras	1886–95	78,363	723	27	5·32	·40	4·85	3·28	2·79	1·99	2·31	29·12
	1896	8,120	688	27	·25	—	2·83	—	2·71	3·45	—	20·81
	1897	8,349	831	33	25·03	·36	6·47	—	2·99	4·19	·24	52·82

* Excluding subsidiary jails.

The prisoners of the Central Provinces, Madras, Burma, Berar, and the North-Western Provinces and Oudh were more unhealthy than in the previous year.

In 1897 the three most unhealthy administrations were, in order, the Central Provinces, Assam, and the Andamans, and the three most healthy were, in order, Berar, Burma, and the Punjab.

As compared with the decennial ratios, cholera mortality was increased in Assam, still more in Bombay, and most of all in Madras ; dysentery mortality was increased in the Andamans, Bengal, the North-Western Provinces and Oudh, more in Madras, still more in Berar, and most of all in the Central Provinces ; diarrhœa mortality was increased in the North-Western Provinces and Oudh, Bombay, Berar, and especially in the Central Provinces.

Mortality from respiratory diseases was increased in the North-Western Provinces and Oudh, Berar, Madras, and still more in the Central Provinces ; phthisis mortality rose in all the provinces except Burma and Assam, and more especially in the Central Provinces and Madras ; and the total mortality increased in the North-Western Provinces and Oudh, Bombay, still more in Berar, still more in Madras, and most of all in the Central Provinces.

It will be noticed in the above table that the Punjab death-rate is not only the lowest of the administration rates, but is also the most favourable as compared with its decennial ratio ; while in both respects the Central Provinces death-rate is its opposite. The difference between the two rates is nearly 119 per 1,000 per annum. The use of prophylactic doses of febrifuges is extending, but the actual distribution of the drugs to the prisoners requires more careful supervision.

Andamans.—The Senior Medical Officer reports that the meteorological conditions of the year were peculiar, and unfavourable to the health of the convicts. Heavy rain in May was followed by a break of a month, and then by an unusually abundant monsoon, the consequence being prevalence of fever and dysentery. Even the women prisoners suffered severely from the fever, though they worked mostly under shelter, drank boiled water, and took prophylactics. He concludes as follows :—

" In recent years many important improvements have been made which are likely to favourably " affect the health of the convicts. Two large hospitals have been built in excellent sites at Bamboo " Flat and Viper ; wells and tanks have been more carefully protected ; and a Larymore boiler has " been installed in every important station. There is also a great improvement in the rice supply, " which is now obtained from Rangoon, and is much superior to the coarse rice formerly obtained " from Bengal. The Settlement gardens have been considerably developed, and the vegetable supply " much improved."

Burma.—The decrease in average annual strength was mainly due to the release of convicts in honour of the Queen-Empress's Jubilee. Notwithstanding the diminution in the number of prisoners, every jail in the province, except those at Thayetmyo, Toungoo, Shwebo and Tavoy, was overcrowded at one time or other during the year ; while in fifteen, including the central jail at Bassein, overcrowding was chronic, though in the majority of cases not to any great extent. The Inspector-General complains that the death-rates in the Burma jails are raised by the deportation to other provinces of the healthiest prisoners, and the return to their native land of such of the deported prisoners as lose their health. The jail at Moulmein has been notoriously unhealthy for many years, and is being reduced from a central to a district jail.

Assam.—The decrease in average strength was partly due to Jubilee releases. The reduction of the death-rate by over 10 per 1,000 of strength must be considered creditable in view of the facts that scarcity was prevalent, that the general health of the provincial population was bad, that ten of the prisoners lost their lives in the earthquake, and that many of the prisoners were exposed for a time to unusual hardships consequent on the demolition of buildings by the earthquake. The constantly sick and admission rates were also slightly reduced. These favourable results are attributed to an improved dietary, better clothing, restrictions placed on extramural labour, and the prophylactic use of quinine and iron.

Bengal.—The special causes unfavourably affecting the health statistics of the jail inmates in Bengal were, according to the Inspector-General, the impoverished physical condition, from famine and privation, of the prisoners on admission to jail ; the prevalence and severity of malarial fevers in the last three months of the year ; the increased number of prisoners admitted with short sentences for offences connected with the scarcity ; the release at the Jubilee of a large proportion of prisoners approaching the end of their sentences, health being usually better at the end than at the beginning of jail residence ; the withdrawal from the province, for war or plague service, of a great number of its most experienced medical officers, who in previous years had done much to improve the health of the prisoners. In many cases, unfortunately, the sanitary improvements which were being carried out in the jails were hindered on account of diversion of funds to meet the expense of repairs rendered necessary by the earthquake of the 12th June 1897. The damage caused by the earthquake deprived several jails of a portion of their permanent accommodation, which could ill be spared, because there was an abnormal increase in the jail population, producing over-crowding from time to time in many of the jails. The trial of the Pasteur filter in several of the jails has not yet been sufficiently extensive in time to warrant the drawing of conclusions.

North-Western Provinces and Oudh.—Although 8,267 prisoners were set at liberty on account of the Queen-Empress's Jubilee, the average annual strength was considerably in excess of that of 1896, and most of the jails were over-crowded. The general state of the public health and the meteorological conditions of the year were unfavourable to the prison population. Scarcity and famine, consequent on the continued drought of 1896, had so deteriorated the public health that a great proportion of the prisoners admitted were in an enfeebled condition. This is strikingly shown by a comparison of the death-rate among the convicts in jail for not more than six months, 44·4 per 1,000, with 29·29, the rate among the remainder. Such prisoners were ill-fitted to contend against the malarial influences engendered by the abundant monsoon rainfall of 1897, and the mortality of the last four months of the year was nearly as great as that of the earlier eight months.

Punjab.—Notwithstanding the release of 1,846 prisoners on account of the Jubilee, there was an increase in the average annual strength of the Punjab jails. The mortality of the second half of the year was much greater than that of the first, a reversal of what had occurred in 1896, the falling-off in the general health being attributed by the Inspector-General to the prevalence of malarial fevers consequent on heavy rainfall succeeding prolonged drought. No less than 50 per cent. of the deaths in 1897 occurred among prisoners who had been less than six months in jail, "a fact," says the Inspector-General, "plainly indicating the necessity for giving special consideration to the convict on admission "to jail, in respect to all matters affecting his health."

Bombay.—Owing to the failure of the crops in 1896 in certain districts, and the consequent general height of prices, there was a rise in the average annual strength; and a considerable number of the newly-admitted prisoners were in a somewhat weakly condition from lack of food. As no convicts could be sent to the Andamans because of the plague, the only considerable relief afforded to the strain on the accommodation was the release of 1,603 prisoners on the occasion of the Jubilee. All the jails, except those at Hyderabad, Kurrachee, and Karwar, were overcrowded at some time during the year, and in all but eight overcrowding was chronic. In some cases the overcrowding was very excessive. The restrictions imposed in consequence of the presence of plague rendered the customary transfers more than ordinarily difficult; but past experience has shown that it would be dangerous to agree with the Inspector-General that overcrowding is more apparent than real, because work-sheds are used as dormitories. No population can be expected to remain healthy if its members have to sleep in the same rooms in which they work.

Berar.—The effect of scarcity, famine, high prices, and immigration from the Central Provinces greatly augmented the criminal population in the Hyderabad Assigned Districts. All the jails were overcrowded; but it is satisfactory to note that there was no outbreak of epidemic disease in any one of them, and no excessive mortality. The Inspector-General of Prisons reports that, with the best results, the drinking-water in the Buldana jail was from June to the end of September boiled before being issued, having been purified and cleared by the use of alum and permanganate of potash.

Central Provinces.—Famine prevailed in nearly all the districts in the Central Provinces, and in spite of every effort made to exclude from the jails unfortunate wretches whom privation had driven to crime, the jails had to serve as poor-houses for a large number of criminal paupers. A common form of crime in the most severely affected districts was the theft of cattle to be killed and eaten by the starving thieves. Such an offence could not be treated as a petty theft, and the condition of the offenders too often precluded the infliction of corporal punishment in lieu of imprisonment. Every prison in the province was overcrowded, and in some instances the overcrowding was very excessive. Every endeavour was used to mitigate the effects of overcrowding by the utilisation of worksheds as dormitories, by the acquisition of neighbouring buildings, and by the erection of temporary sheds. Relief of the district jails by transfers to the central jails was possible to only a small extent, as the latter were also overcrowded. Fortunately material relief was afforded by the release on the 22nd of June of 1,646 prisoners on account of the Jubilee, and, by the Chief Commissioner's orders, of 923 short-term prisoners before the termination of their sentences. The Chief Commissioner calls attention to the effect of these releases on the statistics relating to sickness and death. The Inspector-General of Prisons says:—

"The reasons for the variations between jail and jail, and for the comparatively low provincial rate "of admission to hospital, appears to be that some medical officers prefer treating prisoners with "slight ailments, or in an anæmic condition, outside the hospital, to which they only admit prisoners

" suffering from severe ailments, or presenting suspicious symptoms, or incapacitated for movement.
" This was perhaps a wise course under the special circumstances of the year; indeed, in some jails
" it was a necessary course, as the hospitals were overcrowded."

The practice described should not make any difference in the admission rates, because the orders of Government are that all cases treated, whether in or out of hospital, should be entered as admissions in the hospital register.

Coorg.—There is only one jail in Coorg, that of Mercara. There was a fall in average strength due to Jubilee releases.

Madras.—The occurrence of high prices throughout the presidency and of famine in some areas was followed by a large increase in jail population. There was an increased sick rate and a very largely increased death-rate, the latter being mainly due to epidemics of cholera in the Rajamundry and Coimbatore jails. The death-rate of 1897, however, compares favourably with the death-rates of the last famine years, 1877 and 1878. The report of the Inspector-General of Prisons affords internal evidence that many improvements in the sanitation of the jails are still possible; and it may be hoped that the investigation which followed the outbreak of cholera at Rajamundry will lead to their introduction.

Mortality of prisoners and of troops compared.—A table is, as usual, here given to compare the mortality of prisoners in 1897 with that of soldiers. Taking the death-rate of European troops as unit, the death-rate of native troops will be represented by 0·6, and the death-rate of prisoners by 1·7. The mortality of prisoners was comparatively high as regards cholera, bowel complaints, spleen disease, anæmia and debility, respiratory diseases and tubercle of the lungs. Only from fevers was the European soldiers' mortality highest. The enormously greater liability of the prisoners to death from bowel complaints is well shown in the table. Taking the mortality of the native troops from fevers as 1, that of the prisoners is 1·2, and that of the European troops 5·4. Taking the mortality of the native troops from bowel complaints as 1, that of the European troops is 3·3, and that of the prisoners 16·9. Taking the mortality of the European troops from respiratory diseases as 1, that of the native troops is 4·6, and that of the prisoners 7·5. While the liability of the native soldiers to die from respiratory diseases was less than that of the prisoners, yet these diseases made up a larger percentage of the total deaths among native soldiers than among prisoners. The chief cause of death among European troops was fevers, among native troops respiratory diseases, and among prisoners bowel complaints. Of course, for obvious reasons, too much must not be made of the comparison here instituted:—

Causes of Death.	Died per 1,000 of Average Strength.			Relative Liability in Percentages.				Percentage in Deaths from all Causes.		
	European Troops.	Native Troops.	Prisoners.	European Troops.	Native Troops.	Prisoners.	Total 100.	European Troops.	Native Troops.	Prisoners.
Cholera	1·17	·52	3·94	21	9	70	100	5·1	4·0	10·2
Fevers*	10·03	1·85	2·30	71	13	16	100	43·8	14·1	5·9
Bowel complaints ...	2·76	·84	14·23	15	5	80	100	12·1	6·4	36·7
Spleen diseases... ...	·03	·03	·08	21	21	57	100	·1	·2	·2
Anæmia and debility ...	·06	·17	2·35	2	7	91	100	·3	1·3	6·1
Respiratory diseases ...	·70	3·23	5·26	8	35	57	100	3·1	24·5	13·6
Tubercle of the lungs ...	·56	·79	2·95	13	18	69	100	2·4	6·0	7·6
All other causes... ...	7·62	5·69	7·63	36	27	36	100	33·2	43·4	19·7
All Causes ...	22·93	13·12	38·75	31	18	52	100	100·0	100·0	100·0

* Enteric, intermittent, remittent, and simple continued fevers.

General Population.

General Remarks.—Vital statistics have been well called the foundation of sanitary effort. This description seems to be a very happy one, for not only does it indicate that reliable statistics are essential to the progress of the allied sciences of hygiene and pathology, but it implies the fundamental importance of vital statistics in the consideration of many economic problems. Unfortunately the subject is a difficult one, and it is too often also an uninteresting one. In India the inherent difficulty is increased, while any interest that might be aroused is diminished, by the inaccuracy of the figures. Not only are the returns imperfect, but the population figures, upon which computations must be based, are far from being correct.

The population figures are those obtained at the last census, and even when these were originally correct, the changes which must have taken place in them since 1891 render close reasoning in respect of ratios calculated upon them almost impossible. No amendment in the population figures is possible until after next census; and the corrections which are used in other countries to obtain precise intercensal figures cannot be generally applied with advantage in India.

The returns are certainly improving, and Local Governments and Administrations are alive to the importance of their continued improvement; but nothing approaching the actual facts can be obtained so long as the collecting agency in rural areas remains illiterate, and until sufficient pressure is put upon municipal bodies to enforce the bye-laws under which registration is legally compulsory in towns.

The abnormality introduced into the returns for 1897 by the occurrence of famine in many parts of the country renders any comparison with the figures of former years useless as an index of change in the quality of registration; but just as a traveller reaching an elevation in his path instinctively looks back over the country he has travelled, so a year of unusual statistics gives a fitting opportunity to glance at some of the tendencies exhibited by the returns relating to vital statistics in India since 1892, when the new census figures were first generally used. Little attempt is made to explain anomalies; this must be left to the provincial Sanitary Commissioners, who are in the possession of local knowledge and are able to make enquiries on the spot.

Births.—The following statement epitomises the birth statistics of 1896 and 1897, showing the urban and rural populations under registration, the number of children born, the ratios of the births per 1,000 in 1896 and 1897, with the average ratios of the previous five years, and the numbers of males born to every 100 females born:—

Birth Statistics.

Province.		Number of Municipalities and towns in which births were registered.	Number of rural circles in which births were registered.	Population under Registration.			Total number of births registered.	Ratio of births per 1,000 of population.	Highest birth-rate in any one district.	Lowest birth-rate in any one district.	Number of males born to every 100 females born.	Excess or deficiency of births compared with deaths.	Mean ratio of births per 1,000 during previous five years.
				In Municipalities and towns.	In Districts, excluding towns.	Total.							
Bengal	1896	147	554	3,435,254	67,634,979	71,070,233	2,703,486	38·03	48·98	18·49	106	+ 3·86	Not stated.
	1897	148	557	3,444,512	67,625,105	71,069,617	2,625,844	36·94	47·40	18·46	106	+ 4·00	33·83
Assam	1896	21	59	106,397	4,914,687	5,021,084	169,172	33·69	42·71	24·57	107·44	- 2·64	30·38
	1897	21	59	106,397	4,914,687	5,021,084	163,617	32·59	45·12	19·77	108·13	- 18·02	31·39
North-Western Provinces and Oudh.	1896	492	897	3,241,595	43,663,196	46,904,791	1,660,387	35·40	52·76	22·11	108·86	+ 2·08	36·99
	1897	97?	1,215?	3,210,809	43,693,982	46,904,791	1,458,947	31·10	50·74	13·76	108·98	- 9·36	37·42
Punjab	1896	151	447	1,412,775	19,131,226	20,553,982	884,692	43·0	51·9	17·4	110·1	+11·5	39·0
	1897	151	447	2,013,969	18,540,013	20,553,982	874,623	42·6	57·5	19·3	110·5	+11·5	40·8

Birth Statistics—continued.

PROVINCE.		Number of Municipalities and towns in which births were registered.	Number of rural circles in which births were registered.	POPULATION UNDER REGISTRATION. In Municipalities and towns.	In Districts, excluding towns.	Total.	Total number of births registered.	Ratio of births per 1,000 of population.	Highest birth-rate in any one district.	Lowest birth-rate in any one district.	Number of males born to every 100 females born.	Excess or deficiency of births compared with deaths.	Mean ratio of births per 1,000 during previous five years.
Central Provinces	1896	72	160	811,710	8,689,691	9,501,401	301,427	31·72	44·00	21·75	106·68	-17·59	38·39
	1897	72	161	811,710	8,689,691	9,501,401	254,973	26·83	46·30	16·23	107·76	-42·51	36·11
Berar..	1896	37	67	346,399	2,496,823	2,843,222	109,013	38·3	44·1	31·8	105·3	- 5·5	38·6
	1897	38	67	356,002	2,496,823	2,852,825	113,364	39·7	40·4	37·0	106·7	-12·9	37·6
Lower Burma ..	1896	35	184	588,369	3,926,404	4,514,773	145,688	32·27	42·84	17·91	107	+ 9	25·65
	1897	35	181	588,369	3,926,404	4,514,773	143,659	31·82	40·97	17·61	108	+ 6	27·96
Madras	1896	92	179	2,526,775	30,194,492	32,721,267	979,981	29·9	41·5	22·5	104·8	+ 9·3	27·2
	1897	93	179	2,538,033	30,060,268	32,598,301	935,845	28·7	41·6	20·8	103·9	+ 3·3	27·8
Bombay	1896	63	221	2,304,373	16,515,973	18,820,346	691,847	36·76	47·55	18·35	107·92	+ 5·07	35·41
	1897	63	220	2,304,373	16,515,973	18,820,346	629,693	33·46	44·11	11·29	108·42	- 6·38	35·51
Coorg	1896	*	5	15,511	157,544	173,055	4,606	26·62	32·11	20·70	97·68	+ 0·18	21·95
	1897	5	5	15,511	157,544	173,055	3,503	20·24	26·12	15·36	100·74	-29·79	24·18

It will be seen that although in every province, except Berar, the birth-rates of 1897 are lower than in the previous year, the relative positions of the provinces are not greatly altered—the Punjab and Berar are at the top of the list, and Coorg at the bottom. The North-Western Provinces and Oudh has, however, fallen below Assam and Lower Burma, and the Central Provinces below Madras.

The ratios registered in the past five years show a tendency to increase in every province, except the North-Western Provinces and Oudh, the Central Provinces and Berar. The falling off in Berar is not, however, sufficient to cause that province to lose its high position.

A feature of great interest is the very varying proportion of male and female births registered in the different provinces. In 1897 the percentage of male to female births ranged from 110·5 in the Punjab to 100·74 in Coorg, a higher percentage in the one case and a lower in the other than is generally recorded in countries where registration is supposed to be fairly accurate.* Simple explanations of high percentages may be offered: where the total birth-rate is low and the percentage of males born high, the births of females are not registered; and, where the birth-rate is fairly normal and the percentage is high, the births of females have been registered as the births of males. These simple explanations, no doubt, cover many cases, but by no means all.

An examination of the provincial returns for a series of years shows that the percentage figures in each province are fairly characteristic of that province; for instance, in the Punjab the percentage of male to female infants born during the last ten years has never been so low as 110, while in Madras during the same period it has never been so high as 105; meanwhile the lowest birth-rate recorded in the former province was 34·02 per 1,000 in 1891, and the highest in the latter, 32·4 in the same year.

Deaths.—The following statement gives certain details of the registration of deaths and shows the total mortality in the various provinces in 1896 and 1897, the urban, rural,

* In England and Wales, in 1896, male births were in the proportion of 103·6 to 100 female births, ranging in that year from 111·6 in Rutlandshire and 108 in Suffolk to 101·2 in Gloucestershire and 100·8 in Worcestershire. In the previous sixteen years the percentages varied between 103·3 and 104·1.—Registrar General's Report, 1896.

and total millesimal death-rates in these years, with the quinquennial averages, and the number of deaths of males for every 100 deaths of females :—

Death Statistics.

Province.		Number of Municipalities and towns in which deaths were registered.	Number of rural circles in which deaths were registered.	Number of Deaths Registered.			Ratio of Deaths per 1,000 of Population.			Highest Death-rate.		Lowest Death-rate.		Mean Death-rate during previous 5 years.			Number of deaths of males to every 100 deaths of females.
				In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	In Municipalities and towns.	In Districts, excluding towns.	In Municipalities and towns.	In Districts, excluding towns.	Total.	
Bengal	1896	147	554	124,154	2,304,676	2,428,830	36·14	34·07	34·17	58·30	53·07	15·70	23·68	32·32	30·59	30·67	117
	1897	148	557	120,875	2,220,757	2,341,632	35·09	32·83	32·94	89·59	49·92	14·20	23·62	33·78	32·03	32·11	118
Assam	1896	21	59	4,035	178,382	182,417	37·92	36·30	36·33	68·06	45·78	18·31	29·19	36·63	31·66	30·17	113·89
	1897	21	59	7,098	246,995	254,093	66·71	50·26	50·61	125·17	61·00	22·86	41·58	39·14	32·92	31·45	109·44
North-Western Provinces and Oudh.	1896	492	897	131,150	1,431,744	1,562,894	40·46	32·79	33·32	114·12	67·43	16·07	21·82	36·73	31·88	32·20	117·04
	1897	97	1,215?	155,901	1,741,691	1,897,592	48·55	39·86	40·46	108·05	61·85	24·83	23·67	37·63	32·26	32·63	116·77
Punjab	1896	151	447	50,541	596,962	648,099	35·77	31·20	31·53	48·96	41·59	23·65	22·50	40·45	34·05	34·51	111·0
	1897	151	447	69,363	568,864	638,227	34·44	30·68	31·05	96·12	49·23	12·93	21·30	39·34	34·52	34·99	105·0
Central Provinces	1896	72	160	39,609	428,860	468,469	48·79	49·35	49·31	172·21	85·14	18·95	39·55	31·72	33·94	33·76	119·32
	1897	72	161	66,215	592,607	658,822	81·57	68·20	69·34	510·83	96·24	29·05	29·95	29·61	37·20	37·02	124·54
Berar	1896	37	67	15,255	109,532	124,787	44·0	43·8	43·8	65·7	50·4	23·5	38·7	38·37	39·0	38·8	114·3
	1897	38	67	20,451	129,771	150,222	57·4	51·9	52·6	92·2	60·5	21·8	41·6	39·34	39·6	39·4	117·6
Lower Burma ..	1896	35	184	16,673	90,014	106,687	28·34	22·93	23·63	43·36	28·30	10·68	15·01	29·31	19·54	20·73	120
	1897	35	181	19,026	99,544	118,570	32·34	25·33	26·26	43·89	36·88	15·87	13·91	29·06	21·30	22·37	127
Madras	1896	92	179	73,463	602,324	675,787	29·0	19·9	20·6	72·4	25·3	6·6	14·6	29·0	19·7	20·7	105·6
	1897	93	179	81,056	746,469	827,525	31·9	24·8	25·4	56·8	50·7	7·3	19·0	28·2	19·7	20·4	105·8
Bombay	1896	63	221	85,740	510,732	596,472	37·21	30·92	31·69	60·00	43·67	12·21	16·03	32·22	29·20	29·57	110·0
	1897	63	220	130,723	619,193	749,916	56·72	37·49	39·84	148·78	54·77	10·63	14·41	33·77	29·99	30·45	111·0
Coorg	1896	5	5	503	4,071	4,574	32·43	25·84	26·43	56·89	29·49	21·19	22·37	31·42	25·87	26·26	123·01
	1897	5	5	964	7,894	8,858	62·15	48·84	50·03	116·71	66·47	32·45	34·45	31·62	25·87	27·19	116·07

NOTE.—For population under registration, *see* preceding table.

Except in the Punjab, the death-rate was everywhere higher than the average, and in every province, except Bengal and the Punjab, the death-rates of 1897 were higher than the death-rates of 1896. As in the previous year, the highest death-rates were recorded in the Central Provinces, Berar, and Assam, and the lowest in Burma and Madras. A phenomenal rise in the death-rate in Coorg, from 26·43 per 1,000 to 50·03, raised that small province from the eighth place which it held in 1896 and holds among the quinquennial averages to the fourth place in 1897. The relative positions of the remaining provinces remain unaltered, except that a rise in their death-rates has placed the North-Western Provinces and Bombay above Bengal.

An examination of the death-rates of recent years shows that the provinces may be placed in three groups : where death-rates are very high, comparable with the highest registered in any European country twenty years ago, the Central Provinces and the neighbouring province of Berar, in both of which recent events have been disastrous to the public health ; where rates are low, comparable with those recorded in Prussia, at the present day, Madras and Lower Burma ; and third, where the rates are medium, from 30 to 35, comprising the remaining provinces. In Lower Burma, with improved registration,

the rates are steadily increasing; but in Madras, if the sudden rise in 1897 is excepted, the tendency seems to be towards a decline rather than towards a rise in the rates.

In former years the Central Provinces has furnished an exception to the rule that the average death-rates in towns are higher than the rates recorded in rural areas, but on account of the effect of famine and the flocking into the towns of the starving poor, the excess of rural mortality, which in 1896 had been reduced to ·56 per 1,000, has been changed to a deficiency of no less than 13·37 per 1,000. Elsewhere than in Bengal and the Punjab there was a marked rise in urban mortality as compared with 1896, and everywhere, except in Madras and the Punjab, the urban rates had increased in a greater degree than the rural—in Bombay, Assam, and Coorg the increase was very remarkable. In Madras the rural death-rate increased much more than the urban; and in the Punjab the mortality in towns fell out of proportion to the reduction in rural areas.

Turning now to the column showing the number of male deaths for every hundred female deaths reported, we find in 1897 that 105 males died for every 100 females that died in the Punjab, while in Lower Burma the percentage was 127. This great variation is not paralleled in the returns for England and Wales during the last fifty years, the extremes there having been 105·4 in 1849, and 114·5 in 1877. Indeed, in England from 1878 onwards the figures do not vary much from year to year, and from 1886 to 1895 the average was 112·1, with extremes of 111·1 and 113·6. Every province in India, except Madras, exhibits greater variation in the recorded percentages in the last five years, but when averages are struck the provinces arrange themselves into groups, again three in number—very high percentages, Lower Burma and Coorg; very low, Bombay and Madras; and medium, the remaining provinces. The high percentages in Lower Burma and Coorg may be accounted for by the annual immigration in search of work of coolies, among whom mortality is apparently very high. The percentage in Bombay is increasing steadily. In Madras a low percentage is in part explained by the fact that there is a considerable excess of females in the population. This factor, however, if the census figures are to be accepted as correct, is not influential elsewhere, for the excess of males in the Punjab is greater than in any province except Coorg, while the relative percentage of male deaths is lower than in any province except Madras and Bombay; and though females predominate in the populations under registration in both Bengal and the Central Provinces, the percentages of male deaths are higher in these provinces than in any, except Lower Burma, Coorg, and the North-Western Provinces and Oudh.

Indeed, omitting Lower Burma and Coorg, in Madras alone does the proportion of male to female deaths show any relation either to the varying excess of male births or to the excess of males in the populations as determined at the census of 1891.

With the remarkable exception of the Punjab, the death-rates of male infants in 1897 were everywhere higher than the death-rates of female infants; and, again excepting the Punjab, boys between the ages of one year and five years died at a greater rate in every province than girls of the same ages. As was to be anticipated, the infantile mortality was enormous in the Central Provinces and Berar, but there is a curious anomaly in the returns from these provinces. In England and Wales the records show that there are great variations in the mortality of infants from year to year, but that the variations in the proportion of the sexes dying is small; that is to say, if the mortality of male infants is high, the mortality of females is high also, and *vice versâ*;* and it would be expected that in the province where the death-rate of male infants was highest, female infants would die at the greatest rate; but this is not the case, for the death-rate of male infants in 1897 was highest in the Central Provinces, while female infants died at the greatest rate in Berar.

Major Dyson regards the greater mortality of males in Bengal as easy of explanation. "It is well known," he writes, "that male children are more difficult to rear than female "children, and adult males are more exposed to vicissitudes of climate and accident than "females." The statement that male children are the more difficult to rear does not, however, explain the phenomenon, and the questions arise, are adult males among the masses in Bengal, and in India generally, more exposed to vicissitudes of climate and accident than females? If they are, does this extra exposure compensate for the effects of premature marriage and maternity and primeval midwifery? Whatever the replies to these questions may be, it is a fact that the returns since 1892 show that at every age-period in Bengal, except 15–20, in 1893, and at every age-period in the

* Registrar General Report for 1896, p. xviii.

Central Provinces, the recorded death-rate of males is higher than the recorded death-rate of females. This is, however, not the case in other provinces. In every other province of India proper the female death-rate is higher than the male in the age-period 15–20; and in all these provinces it is the rule for the female rates to be the higher in the following age-period 20–30. Moreover, in Bombay, the Punjab, Berar, and Coorg it is invariable, while in other provinces it occasionally happens that females die at a greater rate than males in the age-period 10–15. That is to say, during the age-periods embracing adolescence and early child-bearing the female death-rates are higher than the male rates. In Burma, where marriage is deferred, the female death-rates are the higher in the age-periods 20–30 and 30–40.

Bengal and the Central Provinces have one factor in common, the female populations are greater than the male; but this predominance is more pronounced in Madras, where the female death-rates are always the higher in the age-periods 15–20 and 20–30, and, except occasionally in the age-period 10–15, at these ages only.

The returns from the Punjab are altogether exceptional; females die at a greater rate than males at every age-period, except in infancy, and in age-periods over 40; and in 1897 the extraordinary phenomenon, not observable in any provincial returns, since 1887 at any rate, of the death-rate of female infants being higher than the death-rate of male infants was recorded. The Punjab ratios may be explained by the female population at nearly all periods being under-estimated at the census.

The following statement shows the monthly incidence of mortality from all causes in each province:—

Statement showing the Deaths from all causes, according to Months, in the different Provinces of India during the year 1897.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1897.	1896.
Bengal	164,049	145,998	211,392	189,410	180,516	162,550	171,842	237,566	199,583	192,428	271,197	215,101	2,341,632	32·94	34·17
Assam	13,854	12,505	15,443	17,124	21,996	24,411	26,306	23,756	22,663	24,958	26,747	24,330	254,093	50·61	36·33
North-Western Provinces and Oudh.	143,956	125,975	145,831	149,863	135,532	120,859	130,244	156,788	180,980	235,060	206,224	166,280	1,897,592	40·46	33·32
Punjab	44,262	34,550	36,492	35,695	41,928	41,672	38,907	41,344	57,162	87,934	98,688	79,593	638,227	31·05	31·53
Central Provinces..	36,547	33,374	36,384	38,362	56,318	71,609	61,445	80,785	81,891	72,069	52,880	37,158	658,822	69·34	49·31
Berar	5,875	5,020	5,703	7,869	11,125	10,368	13,188	25,849	25,665	19,395	11,452	8,713	150,222	52·6	43·8
Lower Burma ..	8,796	8,069	8,639	8,884	8,798	8,662	12,531	11,757	10,749	10,126	10,057	11,502	118,570	26·26	23·63
Madras Presidency	76,843	53,556	52,478	48,706	56,960	63,915	77,480	82,249	76,425	80,452	71,902	86,559	827,525	25·4	20·6
Bombay „	50,854	47,564	54,347	56,449	59,867	60,572	75,732	82,473	71,193	68,829	65,139	56,897	749,916	38·84	31·69
Ajmere-Merwara..	903	738	816	892	1,091	842	659	1,173	1,599	1,830	1,467	1,375	13,385	24·68	28·25
Coorg	490	397	521	545	848	1,031	1,153	1,037	677	711	633	010	8,658	50·03	26·43
Mysore	6,707	5,209	5,937	5,923	6,326	6,466	7,799	7,284	7,584	7,809	9,348	10,496	86,888	17·94	14·21
TOTAL ..	553,136	472,955	573,983	559,722	581,305	572,957	617,291	752,061	736,171	801,601	825,734	698,614	7,745,530	35·63	31·65

Everywhere, excepting Bengal, the Punjab, and Ajmere-Merwara, the numbers of deaths registered were greater than in 1896, the total excess aggregating 862,387. The months in which the greatest mortality occurred were November, October, and August, in the order given. By far the lowest mortality was registered in February, and this was followed, but at a great distance, by January and April. In comparing the monthly distribution of the mortality in the different provinces in 1897 with past years, no conspicuous irregularity is observable; maxima and minima occurred in the same months as in an ordinary year, but the figures are generally much higher.

In the following paragraphs some account is given of the salient features of registration in the different provinces:—

Bengal.—No change was made during 1897 in the system in force in Bengal for the collection of vital statistics. Registration is compulsory in towns; and in rural areas the particulars are collected by the village watchmen and registered by them at the

police outposts and stations. Inspecting officers of the vaccination establishment verify registers and report any errors or omissions that they may find. Errors are corrected and omissions are rectified, while suitable notice is taken of the neglect of the defaulting watchman or policeman. During 1897, 178,528 births and 124,204 deaths were enquired into, and it was found that 3,043 of the former and 1,944 of the latter had not been entered in the *thana* registers. The total number of persons, including watchmen and policemen, convicted of neglect in respect of registration in 1879 was 1,810, against 1,969 in the previous year ; on the other hand, there was an increase from 408, in 1896, to 463 in the number of persons warned.

The conditions affecting the vital statistics in Bengal in 1897 were peculiar, and, making every allowance for defects in registration, the results were extraordinary. The monsoon rains of 1896 ceased prematurely, so that the public health was unusually good during the last quarter of the year, owing to a great decrease in the ordinary mortality recorded under fever. Similar favourable conditions were maintained during the early part of 1897. But the drought, while it lessened fever mortality, led to widespread scarcity, merging in many places into famine. No less than fifteen districts are described by Major Dyson as famine-stricken, while in other four, though the extensive measures of relief necessary in the former were not required, test works were opened and a certain amount of gratuitous relief had to be given. The actual period of famine conditions extended from the beginning of October 1896 to ths end of September 1897. It would appear from the statistics that the scarcity was sufficiently great to check the birth-rate, but not great enough to raise the death-rate in the face of the other generally favourable conditions, for, of the various classified death-causes, only small-pox, dysentry, and diarrhœa and injuries* caused more deaths than in 1896, while fever, which generally causes rather more than two-thirds of the deaths, was only very slightly (about ·30 per 1,000) more fatal than in an ordinary year.

The total number of births registered was 2,625,844, as compared with 2,703,486 in 1896, and the birth-rate, which reached 38·03 per 1,000 in that year, fell to 36·94, which is, however, 3·11 per 1,000 in excess of the quinquennial average. The highest district birth-rates were recorded in Malda, 47·40, Noakhali, 44·71, and Murshidabad, a district affected by the scarcity, 44·64 ; while, excluding Calcutta, the lowest rates were recorded in the Sonthal Parganas, 29·62, a famine district, and Pabna, 28·97, a scarcity district. In the urban district of Calcutta the birth-rate was only 18·46, accounted for in part by the great excess of male population, and in part by defective registration. Among the towns, Jamalpore again heads the list with a birth-rate of 52·62, and in other ten the rates were over 40 ; but in the towns generally the birth-rates were lower than in the surrounding country ; the reasons given for this by the Sanitary Commissioner being the following :—

(1) Excess of the male over the female population.
(2) The existence of a large floating population.
(3) The custom of women leaving the towns to be confined in the country.
(4) Defective registration.

All these causes no doubt contributed in the small towns of Nalchiti, Dinajpur, and Jhalukati, where the lowest birth-rates, 11·94, 11·06, and 2·11 per 1,000, were recorded, and it would seem, in the case of the last-named at any rate, that defective registration is mainly to blame, for the birth-rate has been abnormally low for years past, and in 1897 four male births were recorded for every single female birth.

The percentage of male to female births in the province generally was 106; exceptionally high percentages were recorded in neighbouring districts of Calcutta (114), the 24-Parganas (112), Howrah (111) ; and Hooghly (111), possibly due, in view of the comparatively low birth-rates returned, to defective registration. In none of the famine districts, save Saran (110) and Shahabad (108), were the percentages abnormally high, nor was the percentage more than 107 in any district where the recorded birth-rate was above the provincial average.

The total number of deaths registered was 2,341,632, as compared with 2,428,830 in the previous year, and the death-rate was 32·94 per 1,000, against 34·17 in 1896, and a quinquennial average of 32·11. The highest district death-rate was 49·46 per 1,000, recorded in Chittagong, where not only were large numbers drowned by the storm-wave

* The death-rate from injuries was raised on account of the numbers who perished in the cyclone of the 24th October.

which swept over part of the district during the cyclone of the 24th October, but the privations and the pollution of the water-supplies which resulted were favourable to the development of fever and cholera.

It is an eloquent testimony to the efficacy of the relief measures that the next highest death-rates were only 48·12 in Hazaribagh and 46·48 in Lohardaga. These rates were followed by 42·46 recorded in Backergunge, which was unaffected by famine. The lowest district death-rates were 26·02, 24·42, and 23·88 per 1,000, registered, respectively, in Tippera, the 24-Parganas, and Singbhum.

The average rural death-rate was 32·83, as compared with 35·09 in the towns. In some of the latter the rates were very high, the highest having been 89·59 in Lohardaga, due mainly to cholera; 78·51 in Hazaribagh, where also cholera was very rife; 67·00 in Kotrung, due largely to dysentery and diarrhœa; 66·30 in Chatra, and 61·62 in Daltonganj, due in both cases largely to cholera; and 60·94 in Buxar, ascribed chiefly to fevers. In many of the towns the rates were low, the lowest having been 15·43 per 1,000 in Cossipore-Chitpur, 14·37 in Jhalukati, and 14·20 in Maniktala.

Of the various sects the small Christian and Buddhist communities had the lowest death-rates, 21·69 and 29·08 per 1,000 respectively; Muhammadans and Hindus died at the rates of 33·60 and 32·52 per 1,000; while the "Other Classes," most of whom live in the Southal Parganas and Lohardaga, died at the millesimal rate of 35·63.

The smallest numbers of deaths were recorded in February, June, and January, and the largest numbers in November, August, and December.

The age distribution of mortality is interesting. At all age-periods, save those from 10 to 20, the rates were lower than in 1896; the comparatively low infantile mortality is, of course, in part explained by the defect in the number of births, but in a famine year it is curious that the death-rate of the aged should be much lower than usual.

Infants died at the rates of 239·11 and 194·41 per 1,000 among males and females respectively; and boys and girls between one year and five years of age at the rates of 45·79 and 38·72 per 1,000. As is usual in Bengal, the death-rates of males were higher at all ages than those of females, the respective averages having been 35·87 per 1,000, as compared with 30·03.

Port of Calcutta.—The number of European seamen reported to have arrived in the port during the year under review was 19,608, against 17,053 in 1896, and the average daily population was 1,202, or 78 more than in the previous year. The total number of deaths in hospital was 26, equal to a death-rate of 21·63 per 1,000 as compared with 28·46, the fall being chiefly due to cholera, from which 11 deaths (9·15 per 1,000) occurred in 1897, against 18 (16·01 per 1,000) in 1896.

Among the native floating population the deaths registered during the year numbered 208, against 219 in 1896, the death-rates for the two years having been 8·11 and 8·54 respectively.

Assam.—The arrangements for the registration of vital statistics in Assam, and the area of their collection, comprising the plains districts of the Brahmaputra and Surma Valleys, selected tracts in the Khasi and Jaintia Hills, and in the Garo Hills and the station of Kohima, remained unaltered during the year. Only in the Surma Valley and in Goalpara are the registrars paid, elsewhere village headmen, on whom but little pressure can be brought to bear, are employed. Registers are checked by Inspectors of Vaccination and by the police, but, except in the district of Goalpara, apparently in a perfunctory way. In the towns, where registration is supposed to be compulsory, there were 241 prosecutions for failure to report, against 140 in 1896, and this increase in activity seems to have effected some slight improvement, but in many of the towns, in some of which registration is peculiarly bad, no action was taken under the Acts. In the Garo Hills the birth-rate rose from 37·15 per 1,000 to 40·07; and the death-rate from 33·58 to 51·83. In Kohima the birth-rate rose from 28·64 to 34·25; and the death-rate from 28·07 to 55·59, including 77 deaths which occurred in the dispensary. In the Brahmaputra and Surma Valleys and the Khasi and Jaintia Hills the total number of births was 163,617, as compared with 169,172 in the previous year; and the birth-rate was 32·59 per 1,000, against 33·69, the highest on record, registered in 1896, and 31·39 the mean of the preceding quinquennium. As in previous years, the birth-rate in the Surma Valley, 34·86, was higher than that recorded in the Brahmaputra Valley, 30·39; but the highest district rate was recorded in Goalpara, 45·12; and the rate in Lakhimpur, 35·17, was the same as that recorded in Sylhet. In Goalpara, where for the last three years the highest rate has been registered,

the continued good results are attributed to the personal interest taken in the work by Mr. Ward, the District Superintendent of Police. The lowest rates were 25·53, 25·45 and 19·77, registered respectively in the Khasi and Jaintia Hills, Kamrup and Nowgong. In Nowgong the ravages of *kala azar* have doubtless reduced the population, and the *gaonburas* who collect the statistics are reported to have often been so ill as to be unable to take their reports to their stations.

Among the towns the highest birth-rates were recorded in Golaghat, 42·97 per 1,000, Karimganj, 41·51, Dibrugarh, 40·20, and Hailakandi, 40·00, while the lowest were registered in Silchar, 16·08, Dhubri, 14·30, and Maulvi Bazar, 12·17.

The average percentage of male to female births was 108·13, ranging in the districts from 105·74 in the Khasi and Jaintia Hills to 111·28 in Sibsagar.

The year was an extraordinarily unhealthy one, and the number of deaths was 254,093, exceeding the previous record number by no less than 71,676. The death-rate was 50·61 per 1,000 as compared with 36·33, the highest previously recorded, in 1896, and 31·45 the quinquennial mean. The deaths from fevers were more than 10 per 1,000 in excess of the mean; the death-rate from this cause being less than the mean in only two districts, Goalpara and Sibsagar. In every district, except Sylhet, Nowgong, Lakhimpur and the Khasi and Jaintia Hills, cholera was more prevalent than usual, the average death-rate throughout the province being nearly doubled. Small-pox also was more fatal than usual everywhere, except in the Surma Valley and in Goalpara. Dysentery and diarrhœa were more fatal than usual in every district. The highest district death-rates were recorded in Cachar, 61·18 per 1,000, Sylhet, 53·02, and Goalpara, 50·53; and the lowest in Darrang, 46·74, Sibsagar, 42·95, and Lakhimpur, 41·72.

The nominal causes of the exceptional mortality have been indicated above, but the reasons which determined the activity of these causes are not apparent. The earthquake has been blamed; but the Sanitary Commissioner points out that the mortality was generally least affected in places where most damage had been done by the earthquake, and *vice versâ*. It seems, however, impossible to doubt that the suffering and exposure resulting from the floods and other effects of the earthquake could have failed to affect the public health very injuriously. This is borne out by a comparison of the relations of the death-rate in 1897, in the months before and after the earthquake, with the corresponding figures in other years. It must be remembered that the last seven months are generally more unhealthy in Assam than the first five, and that the first five months of 1897 were peculiarly unhealthy. But if the total death-rate had borne its normal relation to that recorded up till May, it would have been only about 44 per 1,000, whereas it was actually 50·61, and it seems not unfair to ascribe part of the excess to the effects of the earthquake.

The average death-rate in rural areas was 50·26 per 1,000, against 66·71 in the towns. Among the latter, extraordinarily high rates were recorded in Tezpur, 125·17, Dhubri, 112·12, Karimganj, 111·97, Hailakandi, 109·23, Barpeta, 106·84, and Golaghat, 101·31. In Tezpur, cholera, fevers and dysentery and diarrhœa were exceedingly fatal; in Dhubri the high death-rate was mainly due to cholera and dysentery and diarrhœa; in Karimganj and Hailakandi, to fevers; in Barpeta, to cholera and fevers; and in Golaghat, to dysentery and diarrhœa. The lowest urban death-rates were 30·43, 24·26 and 22·86, registered, respectively, in Maulvi Bazar, Shillong and Jowai, small towns in which the mortality from fever was low and cholera was either altogether absent (Jowai) or only a few cases occurred.

Among the different communities, the highest death-rate, 66·48, was recorded for "Other Classes," and the lowest, 36·88, for the comparatively small community of Christians; Muhammadans and Hindus died at the rates of 55·28 and 45·60 per 1,000.

The death-rate among male infants was 251·81 per 1,000, and among females 236·42; and among boys and girls between one year and five years the rates were 62·40 and 61·46 respectively. At all periods, except those between 15 and 30, the male death-rates were the higher, the average mortality among males having been 51·20 per 1,000, against 49·97 among females.

North-Western Provinces and Oudh.—The conditions of the year in these provinces, as elsewhere, were entirely abnormal; the birth-rate was diminished on account of the severe scarcity that prevailed in many districts during the previous year, while the death-rate was increased owing to the effects of the famine, which was widespread in 1897. In the beginning of the year there were nearly half a million persons in receipt of aid in

thirty-seven districts, of which twelve were recognised officially as famine-stricken.* The numbers assisted increased rapidly till a maximum of 1,696,722 was reached on the 27th of February; in March the numbers fell off on account of the harvesting of the spring crops being in operation, but large numbers returned in April and May, and the total did not again diminish until the approach of the rains in June. In September relief works were closed, although gratuitous help was continued in the villages until the middle of October, when the famine was practically at an end. In the margin is given a statement, taken from the resolution by the Local Government on the provincial Sanitary Report, showing the actual numbers on relief at certain dates throughout the famine of 1897.

Dates.	Numbers on relief.
2nd January	496,879.
6th February	1,400,243.
6th March	1,542,122.
3rd April	1,021,126.
1st May	1,289,862.
5th June	1,554,844.
3rd July	861,408.
7th August	542,085.
4th September	416,116.
2nd October	168,337.

The total number of births recorded was 1,458,947 against 1,660,387 in 1896, and the birth-rate fell from 35·40 per 1,000 in that year to 31·10 in 1897, as compared with a quinquennial average of 37·42. The highest district rates were 50·74 per 1,000 in Bulandshahr, 47·48 in Etah, 46·02 in Aligarh, 43·73 in Muzaffarnagar, and 41·78 in Meerut, all prosperous districts. The lowest rates were 13·76 per 1,000 in Banda, 19·49 in Hamirpur, 21·0 in Jhansi, 21·32 in Azamgarh, 22·78 in Fatehpur, and 23·61 in Hardoi, all districts which had suffered more or less from scarcity in 1896. In only twelve districts were the births more numerous than the deaths. The percentage of male to female births rose from 108·86 to 108·98, ranging in the districts from 118·09 in Naini Tal to 102·69 in the neighbouring district of Garhwal. In some of the famine districts the percentages were very high, *e.g.*, Banda 116·93, Cawnpore 112·33, Hardoi 110·69, but almost as high percentages were registered in these districts in 1895, while in districts where there was no famine, *e.g.*, Meerut 112.43, Saharanpur 112·24, high percentages have been registered for years past.

The number of deaths recorded was 1,897,592, as compared with 1,562,894 in 1896, and the death-rate was 40·46 per 1,000, as compared with 33·32 in the previous year, and was 7·83 per 1,000 higher than the mean of the preceding five years. Although the death-rate was so much higher than the average, it must be reckoned a low rate when the circumstances are taken into consideration, for it is actually more than 2 per 1,000 less than in 1894, when the millesimal rate, owing to a widespread epidemic of cholera and great mortality from fever, was 42·51. The highest district rates were 62·07 per 1,000 in Hamirpur, 59·71 in Jalaun, 55·77 in Bareilly, 55·55 in Agra and 55·09 in Fatehpur, and high rates were registered also in Mirzapur, Hardoi, Banda, Lucknow and Rae Bareli. All these districts were severely afflicted by famine, except Agra and Bareilly, in which a fatal and persistent form of malarial fever was present and occasioned a higher mortality than might otherwise have been the case had not the population of these districts shared in the actual scarcity which the high price of food-grains occasioned. The lowest rates were 23·67, 24·10 and 24·63 per 1,000, registered, respectively, in the hill districts of Garhwal, Almora and Dehra Dun.

In rural areas the average death-rate was 39·86, as compared with 48·55 in the towns, in many of which the rates were enormously raised by the influx of the infirm and starving poor. This was particularly the case in most of the following towns, where exceptional rates were recorded:—Hardoi (108·05), Kosi (105·42), Sandila (91·06), Utraula (91·02), Pilibhit (89·71), Kunch (83·38), Orai (81·85), Fatehpur (79·98) and Lalitpur (76·84). In Hardoi the deaths from fever were very numerous, while the enormous death-rate of 46·00 per 1,000 from dysentery and diarrhœa was recorded. These diseases caused high death-rates also in Sandila, Kunch and Fatehpur. In Pilibhit fevers were extraordinarily fatal, 88·17 per 1,000, and in Lalitpur, Sitapur and Fatehpur exceptionally high death-rates of 42·12, 21·57 and 20·96 per 1,000, respectively, were registered under the heading "All other causes." Kosi, Utraula and Orai are comparatively small towns, and the sanitary condition of the first has been the subject of a special report to the local Government. The lowest urban death-rates were 25·75, 25·13 and 24·83 per 1,000, recorded, respectively, in Basti, Sardhana and Bahraich.

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* Cawnpore, Banda, Hamirpur, Allahabad, Jhansi, Jalaun, Jaunpur, Lucknow, Unao, Rae Bareli, Sitapur and Hardoi were recognised as famine-stricken in the beginning of the year. In January and February the following seven were added to the list:—Agra, Etawah, Mirzapur, Bara Banki, Gorakhpur, Azamgarh and Fatehpur. The following eighteen districts are described as "scarcity districts":—Dehra Dun, Muttra, Farukhabad, Mainpuri, Etah, Bareilly, Bijnor, Budaun, Moradabad, Shahjahanpur, Pilibhit, Benares, Basti, Kheri, Fyzabad, Gonda, Sultanpur and Partabgarh.

Among the sects the highest death-rate was 40·91 per 1,000 registered among Hindus, Muhammadans follow with 37·95, then "Other Classes" 33·51, and, lastly, Christians 11·58.

The monthly mortality, which had been above the average until May, fell to a minimum in June, when it was below the average of the previous ten years; there was a slight rise in July, and a further rise in August and September, until October, when the mortality mounted upwards; it fell slightly in November and considerably in December.

Among male infants the death-rate was 262·97 per 1,000, and among females 255·10; among boys and girls between one year and five years of age the millesimal rates were, respectively, 73·64 and 72·78. At all age-periods, save that between 15 and 20, the male death-rates were the higher, the excess rising generally with advancing age; and the average male death-rate was 42·06 per 1,000 against 38·73 among females.

Punjab.—No alteration in the method in force for the registration of vital statistics was made during the year, and the comparatively high standard of efficiency attained in the Punjab in recent years was maintained, in the opinion of the provincial Sanitary Commissioner, mainly by the inspection of registers. These inspections are carried on by tahsildars, vaccinators and special divisional inspectors of registration. The work done by tahsildars seems to be of little value, so far as the detection of omissions is concerned at any rate; the inspection by vaccinators is fairly effective; and the work of the special inspectors seems to be very good. The number of *chowkidars* fined for neglect was 488—not a very large number, but enormous in comparison with the 59, which was the total number of persons fined in the municipal towns for breach of the bye-law regarding registration.

The number of births registered during the year was 874,623 against 884,692 in 1896. Although the birth-rate of the year, 42·6 per 1,000, was slightly lower than the rate recorded in the previous year, when it was 43·04, it is considerably higher than the quinquennial mean of 40·8. The highest district birth-rates were 57·5 and 53·2 recorded in Jhang and Gujranwala, where the population has largely increased since the census of 1891 on account of the opening of the Chenab Irrigation Canal. The next highest rate was 49·6, recorded in Karnal, and from this the rates fall until 31·4 per 1,000 is reached in Hazara, 30·3 in Kangra, 30·5 in Peshawar and 19·3 in Simla. Hazara and Peshawar are frontier districts in which probably one-third of the births are not registered, the former shows a falling off in the improvement secured in the last few years, the latter is gradually improving. Kangra and Simla are both hill districts; in the latter, which is the only district in which the number of deaths exceed the births, there is a great excess of males in the population, a condition which obtains in Kangra also to a slight extent. As compared with 1896 the districts of Hissar, Jhelum and Gujrat show a falling off, very marked in the case of Hissar, due to emigration from them on account of famine.

In the province generally there were 110·5 male infants born for every 100 female infants, the percentage ranging from 141·3 in Peshawar to 105·3 in Kangra. It is curious that the extremes should both be districts in which registration is apparently most defective. Admitting that the concealment of female births is general throughout the province, it might be expected that the majority of omissions detected in the birth and death registers would refer to females. But this is not the case. Vaccinators and inspectors alike found the greater proportion of omissions referred to males; although the special inspectors found a higher proportion of omissions in registering the deaths of females. No satisfactory explanation of the excessive proportion of male births registered is given, and criticism in the light of the proportion of omissions detected in the registers is of little value, since it is not explained what exactly constitutes an omission.

The year was unusually healthy, and the number of deaths recorded fell from 648,099 to 638,227. The death-rate was 31·05 per 1,000 against 31·53 in 1896, and a quinquennial average of 34·99. There was a notable decrease in the mortality from small-pox, which was epidemic in 1896, but this was almost exactly balanced by an increased mortality under "Fevers." There was a smaller number of deaths from cholera and from "Other causes," but dysentery and diarrhœa were more fatal. The highest district death-rates were 50·2, 45·3 and 44·3 recorded, respectively, in Dera Ismail Khan, Hissar and Muzaffargarh. In Dera Ismail Khan and Muzaffargarh, as well as in Bannu, Karnal and Jhang, the mortality from fever in the autumn was very high. In Hissar there was scarcity, and although only two deaths from actual starvation were reported, there was exceptional mortality among young children and old persons. The lowest district death-rates were registered in Peshawar, 22·9 per 1,000, and in Simla and Gujrat, 21·9 respectively.

The average mortality in rural areas was 30·68, as compared with 34·44 per 1,000 in the towns, where cholera, dysentery and diarrhœa, and diseases classed under the heading "Other causes," were more fatal than in the country. The highest urban death-rates were 96·12 and 78·36 per 1,000, recorded in Khairpur and Karor, small towns in Muzaffargarn and Dera Ismail Khan, where fevers were exceptionally prevalent. The town of Dera Ismail Khan, which comes next with 75·28, is very ill-drained and fevers were exceedingly fatal, The lowest death-rates were recorded in the Miani 15·79, Montgomery 15·12 and Abbottabad 12·93.

The Muhammadan death-rate was 31·24, and the Hindu 30·78, the relative positions of the two sects being reversed since last year. Native Christians were reported to have died at the rate of 17·25, and "Other Classes" at the rate of 114·55. It seems clear that registration is neglected among the native Christian community, and that most of the unknown dead are returned among "Other Classes"; whenever the population of the former was considerable, the death-rates were very low; and in Delhi the number of deaths registered among "Other Classes" was more than six times the local census population of that community. By far the highest death-rates were registered in November and October when fever was rife; and the lowest rate was registered in February followed fairly closely by April and March.

Male infants died at the rate of 223·02 per 1,000, and females at the rate of 228·02. Boys and girls below five years of age died, respectively, at the rates of 58·42 and 66·76, and at all age-periods, except those between 40 and 60, the female death-rates were the higher, the total male death-rates having been 29·6 as compared with 32·7 among females.

Central Provinces.—The year 1897 was one of extraordinary misery in the Central Provinces. The acute distress which, in 1896, succeeded the localized scarcity of 1894 and 1895, was followed by severe famine involving nearly every district in the province. In January there were 217,762 persons receiving relief, and the number rose in May to a maximum of 691,890; in October, after a defective but well-distributed monsoon rainfall, when the new crops provided cheap food, the numbers began to fall, and, in November, those receiving aid from Government numbered only 151,446.

The number of births registered was 254,973, as compared with 301,427 in 1896; and the birth-rate, 26·83 per 1,000, was the lowest on record—4·9 per 1,000 less than in 1896, and nearly 10 per 1,000 less than the low average in the preceding five years. In 1896 the district birth-rates were generally very low, but in 1897 they were still lower in 14 districts, and the six remaining, Chhindwara, Nimar, Nagpur, Wardha, Chanda and Sambalpur, with the exception perhaps of the first named, escaped more or less from the worst effects of famine. In only one district, Sambalpur, where there had been failure of harvests and the numbers on relief never exceeded ·035 per 1,000 of the population, were births more numerous than deaths; in every other district the death-rates were higher than the birth-rates. In Burhanpur and Chanda the excess of deaths over births was comparatively small, 3·59 and 6·93 per 1,000, but in the other districts the figures ranged from 15·21 in Nagpur and 15·39 in Chhindwara to 80·26 in Murwara and 82·00 in Mandla. Among the districts the highest birth-rates were noted in Nimar, 46·30 per 1,000, Burhanpur, 40·19, Wardha, 39·83, and Sambalpur, 39·24; in only four other districts, Chhindwara, Nagpur, Chanda and Betul, were the rates over 30 per 1,000. In six districts the birth-rates were less than 20 per 1,000, namely, Narsinghpur 19·72, Saugor 17·52, Murwara 16·79, Damoh 16·77, Mandla 16·36, and Balaghat 16·23. It is remarkable that in all these districts the percentage of male to female births was higher than the provincial average, in some cases very much so; in Saugor the percentage was 117·34, in Mandla 113·58, in Narsinghpur 113·16, in Damoh 111·26, in Murwara 108·53, and in Balaghat 108·09. In four other districts percentages above the average were recorded—in Nimar (109·59) and Wardha (108·64), where the birth-rates were fairly high, and Jubbulpur (108·48) and Bilaspur (109·60), where they were low. The smallest percentage noted in any district was 105·01 in Chhindwara.

In the report for 1896 we had to record a death-rate which, except in 1878, had never been nearly equalled in the Central Provinces; in 1897 the death-rate was more than 20 per 1,000 higher than in 1896. The total number of deaths registered was 658,822, as compared with 468,469 in the previous year, and the death-rate was 69·34 per 1,000 as compared with a quinquennial mean of 37·02. The effects of famine are clearly written in the mortuary register of every district save Sambalpur. In every district the death-rate was higher than the average of the preceding five years, and in only two were the rates lower than they were in 1896. These two exceptions were Damoh, where the enormous death-rate of 88·28 per 1,000 was recorded in 1896, and Sambalpur, where, as has been

already stated, distress was limited. Cholera was more than twice as fatal as is ordinarily the case ; dysentery and diarrhœa caused more than four times the high average death-rate of recent years ; and fevers, to which 59 per cent. of the total mortality was ascribed, caused a death-rate of 40·98 per 1,000, as compared with a quinquennial mean of 23·13. In 171 of the 233 circles of registration the death-rates were in excess of 50 per 1,000, including forty-five in which there were upwards of 90. In only one circle was the rate lower than 25, although in the other five they were less than 30. Among the districts the highest death-rates were recorded in Mandla, 98·36, Murwara, 97·05, and Bilaspur, 95·54 ; the lowest were recorded in Burhanpur, 43·78, Chanda, 41·58, and Sambalpur, 30·22. High as was the average death-rate in rural areas, 68·20 per 1,000, it was far exceeded in the towns where 81·57 per 1,000 of the census population died. In many of the towns, of course, the rates were raised by the inclusion of the deaths of starving wanderers from the surrounding country in search of food, who died in the poor houses, orphanages and other temporary establishments where the succour of the helpless was attempted. The effect of this migration is well seen in the difference in the proportions of the various causes of death in rural areas and in town circles of registration, although allowance must be made for the less faulty classification of disease in the latter. The millesimal death-rate from dysentery and diarrhœa in the country was 6·99, while it was 25·16 in the towns. Deaths from "All other causes" showed an excess of 9·00 per 1,000 in the towns, as compared with the country ; and, as might be expected, small-pox and injuries caused more deaths in the former. Under the heading of fevers the rural mortality was 12·92 per 1,000 higher than the urban ; and to cholera was attributed 6·11 deaths per 1,000 in the country, against 4·87 in the towns. The highest death-rate in any town was 510·83 per 1,000 in the small town of Mungeli in the district of Bilaspur ; this was followed by 313·21 in Murwara, the only town in the district of the same name. In Burha (306·73), Bilaspur (297·34), Mandla (238·87), Seoni (203·99), Khurai (264·19), Rehli (207·85), Damoh (202·59), Sehora (207·31) and Lakhnadon (285·36), rates in excess of 200 per 1,000 were recorded. The death-rate exceeded the birth-rate in every municipal town except Pandhurna in Chhindwara.

The lowest death-rate was 52·61 among Muhammadans, followed by 59·72 among Hindus. Among "Other Classes," comprising the savage or half savage aboriginal tribes, the rate was 126·23 per 1,000. These poor people are largely dependent on the produce of their jungles, so that they speedily feel the effect of unfavourable seasons, and being timid and unwilling to undertake organized work at the best of times, are peculiarly difficult to assist effectively in times of famine.

Every month of the year levied a larger tribute of mortality than in 1896. The death-rate fell to a minimum of 3·51 per 1,000 in February, and rose rapidly after March to 7·54 in June ; after a slight fall in July, it rose in August, to a maximum of 8·62 in September; it fell slightly in October and rapidly in November to a millesimal rate of 3·91 in December.

Infantile mortality was enormous, reaching 403·00 and 356·11 per 1,000 among males and females respectively. Boys and girls over one year and under five years of age died at the rates of 79·64 and 63·78 per 1,000. At all ages the male death-rates were the higher, the average rates for males and females having been, respectively, 77·02 and 61·67 per 1,000.

It is a feature of the mortality in the Central Provinces that the male death-rates are higher at all ages than the female rates ; but while there is generally an approximation to equality on account of a comparative rise in female mortality at the child-bearing ages, no such rise was perceptible in 1897.

No change in the systems in force for the collection of vital statistics was made during the year ; but, as evidenced by a great increase in the numbers against whom proceedings were instituted under the Act, more attention is being given to the matter in municipal towns.

Berar.—There was again some improvement in registration in Berar, due probably to the inspection of registers, of which a larger number were examined than in the previous year. Registration appears to be most defective in Basim and in Wun, but improvement may be looked for, as there was a considerable increase in the number of registers examined in the former district, and a great increase in the latter. In towns registration is still defective, but is improving, except in Ellichpur and Khamgaon, where greater attention on the part of the municipal authorities is required.

The number of births registered was 113,364, as compared with 109,013 in 1896, and the birth-rate, 39·7, was 1·4 per 1,000 higher than in that year, and 2·1 in excess of the

quinquennial mean. The highest district rate was 40·4 recorded in Akola, and the lowest, excepting 37·0 in Basim, where registration is bad, 39·9 in Buldana. The average birth-rate in rural areas was 39·8, the provincial average being lowered by the rates in towns, of which the average was 38·8. Some of the urban rates were high, 51·3 in Akot, 47·0 in Wadegaon, both in the Akola district, and 47·0 in Pusad in Basim. None of the rates were very low, 31·0 per 1,000 in Umarkhed, and 29·6 and 26·7 registered, respectively, in Ellichpur Civil Station and Ellichpur City, being the lowest.

The percentage of male to female births was 106·7, the extreme variations being 146·6 in Barsi Takli and 84·7 in Digras, both small towns in which in other respects normal rates were registered.

There was a remarkable variation in the monthly birth-rates. Ordinarily, the largest numbers of births occur in August, September and October; in 1897 the largest numbers were recorded in February, March and July. The numbers of births in every month up to the end of July were in excess of the decennial mean; in August the numbers fell and remained below it, the falling off in December being 1,690 less than the decennial mean, and 3,651 less than in December 1896. Lieutenant-Colonel Little explains the falling off as due to the effects of famine, which began to be felt in October 1896, diminishing fecundity; and it was observed that women driven to relief centres were rarely pregnant. This, however, does not explain the excess of births in the first part of the year.

The total number of deaths recorded was 150,222, and the death-rate, except in 1878, when it was 81·5 per 1,000, was the highest on record, 52·6 as compared with 43·8 in 1896, and 39·4, the average of the preceding five years. The highest district rate was 61·1 per 1,000 in Amraoti, where large numbers of starving immigrants, coming from the Central Provinces in search of work and food, died. In the other districts the rates ranged from 55·5 per 1,000 in Akola to 42·1 in Wun. The rural death-rate was 51·9, slightly below the provincial average, while the urban rate, 57·4, was considerably above it. In the towns the rates were raised by the influx to them of the starving poor to relief works; the same cause, of course, lowered the rural rates. The highest urban rates were 92·2 per 1,000 in Morsi, where besides cholera, fever and dysentery and diarrhœa were exceptionally fatal, 91·3 in Pusad, and 86·0 in Talegaon, in both of which cholera was severe.

The Muhammadan death-rate was 45·8, as compared with 51·9 among Hindus, among whom the outcaste tribes are very poor. Christians died at the rate of 44·5, and "Other Classes," mainly made up of the timid and impoverished aboriginal tribes who suffered severely from famine, at the rate of 82·7 per 1,000.

The lowest death-rates were recorded in February and March, and the highest in August and September, when the wet cold weather of the monsoon proved fatal to many of those enfeebled by the effects of famine.

There was a great increase in mortality at the extremes of life. Infants, male and female, died at the rates of 325·9 and 360·9 per 1,000, as compared with 273 and 233 in 1896; boys and girls under five died, respectively, at the rates of 101·1 and 91·0, as compared with 97·5 and 81·5; while old men and women, aged 60 and upwards, died at the rates of 150·3 and 127·2 respectively, as compared with 107·4 and 96·6 in the previous year. At all age-periods, save those between 10 and 30, the male rates were the higher, the average being 55·3 per 1,000 for male and 49·9 for females.

Madras.—There was no alteration made during 1897 in the method in use in Madras for the collection of vital statistics, which has been described in former reports. A suggestion was made by the Deputy Director of Agriculture that birth registers should be used in rural areas to check vaccination. The adoption of this check was, it is stated, suggested by Lieutenant-Colonel King in 1891, and has been in successful operation in municipal towns in Madras since 1895.

The total number of births recorded during the year fell from 979,981 in 1896 to 935,845, and the birth-rate from 29·9 to 28·7, as compared with 27·8 per 1,000 the quinquennial mean. Although registration continues to be defective, the falling off in the number of births, which was recorded in fifteen districts, is believed by the Sanitary Commissioner to be due to an actual decrease in the number of children born, because of the large number of marriages postponed as a result of the native prophecy that a cycle of famine and pestilence was about to begin. The highest district rates were those recorded in Madras (Town) 41·6 per 1,000, Chingleput 37·1, and Kistna 34·9; and the lowest in Godavari 25·4, Ganjam 23·9, and Malabar 20·8. The average rural birth-rate was 28·4 per 1,000, as compared with 32·7 in the towns.

There were 104 boys born against every 100 girls, the district percentages ranging from 109·2 in Ganjam to 98·7 in the Nilgiris. In the former district registration is

peculiarly defective; and in the latter the population is comparatively small, so that variations from year to year must be expected—in 1896 the percentage of boys born to girls in the Nilgiris was 117·0.

The millesimal birth-rate fell from 2·3 per 1,000 in January to the minimum of 2 in February; it gradually rose in July to 2·7, fell slightly in August and September to rise again to 2·7 in October, and then declined rapidly until the end of the year.

The number of deaths registered was 827,525, as compared with 675,787 in 1896, and the death-rate rose from 20·6 per 1,000 in that year to 25·4, or 5 per 1,000 above the quinquennial mean. The death-rate was higher than that of the preceding year, and in excess of the mean in fifteen districts; in seven of these, Anantapur, Bellary, Cuddapah, Ganjam, Godavari, Kurnool and Vizagapatam, the presence of famine was officially recognized, and in two, Malabar and South Canara, the pinch of scarcity was felt. The highest district rates were 50·1 recorded in Ganjam, where, besides cholera, small-pox was exceedingly prevalent, 35·8 in Madras (Town), and 31·6 in Vizagapatam. The lowest district rates were 20·1, 19·5 and 19·3 recorded, respectively, in Coimbatore, Nellore and Salem. In rural areas the average death-rate was only 24·8, as compared with 31·9 in the towns. Among the latter, the highest rates were recorded in Cannanore, 56·8 per 1,000, where the high rate was largely due to great mortality (28·5 per 1,000) from cholera; 53·2 in Kurnool due to fevers and "Other causes"; and 50·5 in Calicut, where cholera was rife. The lowest urban rates were 9·8, 9·7 and 7·3 registered, respectively, in Shendamangalam, Samalkot and Ambur.

The Muhammadan death-rate, 27·3 per 1,000, was the highest, followed by that of the Hindus, who constitute about 90 per cent. of the population, with 25·5; Native Christians died at the rate of 17·9, and "Other Classes" at the rate of 12·5.

The smallest numbers of deaths were registered in February, March and April in the order given; and the largest numbers in August and December.

The death-rates of infants were 148·9 and 124·2 per 1,000 of males and females, respectively, a slight reduction as compared with 1896 in the case of males, due, no doubt, to the decrease in the number of infants born, for there was a notable increase in the mortality at all other age-periods, the numbers of boys and girls under five who died rising from 24·9 and 22·8 per 1,000, respectively, to 30·2 and 28·3. At all age-periods, save those from 15 to 29, the male death-rates were the higher, the average being 26·4 per 1,000 for males, against 24·4 for females. In the death-rates of the sexes in the age-periods 20 to 29 and 30 to 39 there is a curious departure from the normal proportions as determined by the death-rates of the past five years. In the earlier age-period, while the male rate is slightly increased, in harmony with the general rise in mortality, there is a disproportionate increase in the female rate. In the later age-period conditions were reversed, the female death-rate is normal, and that of males greatly increased.

Coorg.—The total number of births recorded in Coorg was 3,503, a decrease of no less than 1,103 as compared with the number recorded in 1896; and the birth-rate fell from 26·62 in that year to 20·24, against a quinquennial average of 24·18. Registration is admittedly defective, and the excess of males among the population is nearly 20 per cent., but as there is no reason to believe that the registration of vital statistics became more defective during the year, or that the female population decreased, it must be concluded that there was a remarkable falling off in the number of children born. The rates in the various districts varied from 15·36 per 1,000 in Yedenalknad, where the disparity in the numbers of the sexes is greatest, to 26·12 in Nanjarajpatna, where it is least. The percentage of male to female births was 100·74, as compared with 97·68 in 1896, and ranged from 108·14 in Merkara Taluk to 93·63 in Kiggatnad.

The year was a remarkably unhealthy one, and a severe form of fever, described as malarial, attacked rich and poor alike and proved exceedingly fatal. The number of deaths registered was 8,658, by far the largest number ever recorded, and 4,084 more than in 1896. The death-rate was 50·03 per 1,000, against 26·43 in the previous year, and 27·19 the quinquennial mean. The death-rate was higher than the birth-rate in every taluk, and ranged from 34·45 in Kiggatnad to 66·47 in Padinalknad. In rural areas the death-rate rose from 25·84 in 1896 to 48·84 per 1,000, as compared with a ratio of 62·15 in the five towns, where the average rate in 1896 was 32·43. In the towns many coolies from Malabar, South Canara and Mysore died in hospital, so that the urban death-rate is exaggerated.

Among Hindus, who form the bulk of the population, the millesimal death-rate was 48·84; among Muhammadans it was 49·82; and among the small population of "Other

Classes," 103·53. The number of deaths fell to a minimum in February, gradually rose to a maximum in July, and then declined, with the exception of a slight rise in October, to the end of the year.

The death-rate among infants was 359·85 per 1,000 among males, and 331·37 per 1,000 among females, as compared with 260·89 and 230·87, respectively, in 1896. There was a great rise in the death-rates of children under five, from 34·09 and 30·28 per 1,000 for boys and girls, respectively, in 1896 to 77·06 and 78·41 in 1897. The female death-rate was 51·94, or 3·45 higher than the male, and only in infancy and in the age-periods 5 to 10 and 40 to 50 were the male rates the higher.

Bombay.—The total number of births registered in the Presidency of Bombay, including Sind, was 629,693, as compared with 691,847 in the previous year; and the birth-rate fell from 36·76 per 1,000 in 1896 to 33·46, or 2·05 per 1,000 below the quinquennial average. The birth-rates were lower than in 1896 in all the registration districts, and in only three of the 24 collectorates, Thana, Thar and Parkar, and Upper Sind Frontier were they higher. In Thana the total rate was considerably higher than the average of the previous five years, while the urban rate was lower than in 1896, which suggests that the increase in the rural areas may be due to immigration of women from plague-stricken centres. The highest district rates were 44·11, 42·39 and 41·73 per 1,000 recorded, respectively, in Khandesh, Broach and Nasik; the lowest were 26·37 in Karachi, 18·05 in Hyderabad, and 11·29 in Bombay City.

The rural birth-rate was 34·66 against 24·85 in the towns. Among the latter, the highest rates were recorded in Vengurla 56·22, Sangamner 55·68 and Kapadvanj 54·17; while the lowest rates were registered in Thana 14·61, Bombay 11·29 and Poona 10·44, in all of which plague was severely epidemic.

The percentage of male to female births was 108·42, ranging from 135·0 in Hyderabad to 102·49 in Panch Mahals.

The total number of deaths registered was 749,916, as compared with 596,472 in the previous year, and the death-rate was 39·84 per 1,000, as compared with 31·69 in 1896, and 30·45 the quinquennial average. In accounting for the rise in the death-rate two factors must be taken into account—the presence of famine and the epidemic of plague. As a result of the famine, cholera was more rife than usual, and caused 3·03 deaths per 1,000 of the population, as compared with a quinquennial average of 1·48, and dysentery and diarrhœa were exceedingly fatal, giving rise to a death-rate of 4·57 per 1,000, against an average in the preceding five years of 1·85. The epidemic of plague not only occasioned a recorded death-rate of 2·49 per 1,000, but many plague deaths were registered under some other heading, and the special exertions made to detect cases stimulated the registration of deaths from all causes. It would be useful as well as interesting to ascertain the actual death-rate from plague, but defects in registration and the peculiar conditions of the year render this difficult, if not impossible. The registered excess of the total mortality in 1897 over the mean of the preceding five years was 9·39 per 1,000. From this must be deducted the excess attributed to cholera (1·55), dysentery and diarrhœa (2·72), small-pox (·01) and injuries (·05), which aggregate 4·33 per 1,000. The balance, 5·06, must be divided among "Fevers" and "All other causes." The fever death-rate in 1897, which includes deaths from plague, was 24·05, or 2·49 per 1,000 more than the quinquennial average of 21·56; and 2·49 is very curiously exactly the recorded millesimal death-rate from plague. The mortality registered in 1897 under "Other causes" in excess of the five years' mean was 2·58. In other provinces where there was scarcity but no plague fever death-rates have been raised, so it may be concluded that had there been no famine in Bombay the fever death-rate would not have been much higher than normal in spite of the plague; and, indeed, meteorological conditions favoured a low fever death-rate. If to plague is assigned all the excess mortality under "Fevers" (2·49) and "Other causes" (2·58), the actual death-rate from plague would be over 5 per 1,000, which would mean that rather less than half the actual number of deaths from plague were recorded as due to that disease. The highest district death-rates were 58·89 per 1,000 in Bombay City, 56·95 in Poona, 55·64 in Nasik and 54·92 in Satara, in all of which plague was virulently epidemic; the lowest were 21·11 per 1,000 in Panch Mahals—one of the two districts where no plague death was registered—19·86 in Thar and Parkar, and 15·92 in Hyderabad. In Thar and Parkar there were only two deaths attributed to plague, but there were 499 in Hyderabad, both are in Sind, where registration is defective.

The rural death-rate was 37·49 per 1,000, as compared with 56·72 in the towns. Among the latter, the highest death-rates were 148·78, 100·97 and 99·73 per 1,000, registered, respectively, in Karad, Sholapur and Nasik, due in the first two cases to high rates under

fever, and in Nasik to a comparatively high fever rate and the enormous rate of 22·66 per 1,000 under dysentery and diarrhœa. The lowest urban death-rates were 26·14 in Kumta, 21·77 in Karwar, both in Kanara, a district in which plague did not appear, and 10·63 in Ahmedabad Cantonment.

Among the various sects, the Hindus had the highest death-rate, 42·64, then the Christians, 37·74, Parsis followed 32·56, and then Muhammadans with 30·14. The considerable population, 224,773, of "Other Classes," including Buddhists, Jews, Sikhs, and "unspecified," died at the rate of only 9·95 per 1,000. It is obvious, from an examination of Annual Form V., that this is absurdly wrong, and is due to deaths among "Other Classes" being credited to some other section, *e.g.*, in the district of Broach the population of "Other Classes" is 17,828, and in Panch Mahals it is 11,086, but no death was registered among them; while in the same districts, three deaths occurred among an aggregate Christian population of 136.

The monthly death-rate fell to a minimum in February, and then rose gradually to a maximum in August, fell rapidly in September, and afterwards gradually until the end of the year.

Infants died at the rates of 212·77 males and 188·43 females per 1,000; and boys and girls between the ages of one year and five years at the rates of 64·18 and 60·77 per 1,000. At all ages, save from 5 to 19, the death-rates of males were higher than those of females, the differences increasing with advancing years, the average male death-rate being 40·68 as compared with 38·95 among females.

Burma.—Registration is in force throughout Lower Burma, except in the Northern Arakan and Salween districts, and in parts of the Akyab, Bassein, Thayetmyo and Toungoo districts; the census population concerned comprising 2,388,758 males and 2,126,015 females. In Upper Burma registration, in 1897, was confined to the populations of the towns of Mandalay, Myingyan, Pyinmana and Yamethin, aggregating 227,310 souls; but the registration of births and deaths is about to be gradually introduced into other towns, and the registration of deaths into all the more populous and civilized areas. The system in force in Lower Burma, whereby registration is carried out in municipalities and towns by special paid registrars or ward headmen, in villages by headmen appointed under the Lower Burma Village Act, and in rural areas by the police, continued in force; but amended rules to fix responsibility and simplify procedure were issued in April 1897.

The total number of births recorded during the year was 143,659, about 2,000 fewer than in the preceding year, and the birth-rate was 31·82 per 1,000, against 32·27 in 1896. There seems to be no reason to fear that the improvement in the registration of vital statistics which has been brought about in recent years is not to be maintained, for although lower than that of 1896, the birth-rate of 1897 is higher than that recorded in any previous year, and is 3·86 per 1,000 in advance of the quinquennial mean. The highest district birth-rates were 40·97, 40·43 and 38·83 per 1,000 recorded, respectively, in Sandoway, Pegu and Myaungmya, and the lowest 27·18, 26·52 and 17·61 in Amherst, Thâton and Rangoon Town district. In view of the low district rate recorded in the Thâton district, it is remarkable that in the town of the same name the birth-rate should be the second highest, 38·21 per 1,000, being preceded only by the town of Kawkareik, where the birth-rate was 47·79.

In the province as a whole 108 male children were born for every 100 female children, the rates varying from 116 in Rangoon Town district to 104 in Sandoway. Among the various communities there was great variation in the percentage of males born as compared with females, 115 among Christians, 109 among Hindus, 108 among Burmese and among "Other Classes," and 104 among Muhammadans. These variations seem to have no relation to the birth-rates, which ranged from 33·47 among the Burmese to 21·32 among Christians, and 8·57 per 1,000 among Hindus.

In the province as a whole the largest number of births was recorded in December, and the least in April.

The total number of deaths registered was 118,570, against 106,687 in 1896, and the death-rate, which was the highest on record, was 26·26 per 1,000 as compared with 23·63 in the previous year, and 22·27 the quinquennial mean. In the districts the highest rates were 38·33 recorded in Rangoon Town district, 36·73 in Pegu, and 32·61 in Myaungmya; while the lowest were 18·94 recorded in Thâton, 18·11 in Tavoy, and 14·44 in Mergui. In rural areas the average death-rate was 25·33 against 32·34 in the towns, where the rates ranged from 43·89 and 38·24 per 1,000 in Zigon and Myaungmya, respectively, to 17·87 in Shwedaung, 17·76 in Mergui, and 15·87 in Thônzé.

Of the sects, the Hindus had the highest death-rate, 31·51 per 1,000, and the Christians the lowest, 15·21, "Other Classes" occupying an intermediate position with 23·38 ; the rate among the Burmese was 26·68, and among Muhammadans 20·85.

The lowest mortality was recorded in February, the differences in the other five months of the first half of the year being slight; there was a sudden rise in the death-rate in July, when the largest number of deaths was registered, and a slight gradual fall until December, when the number of deaths again began to rise.

Among male infants the death-rate per 1,000 living was 269·24 as compared with 188·24 among females, both a considerable advance on the rates in 1896 ; a similar advance in the mortality was recorded among boys and girls between one year and five years of age, the rates having been, respectively, 35·66 and 30·53, against 33·60 and 28·57 in the previous year. The average death-rate among males was 27·76 against 24·58 among females, and at every age-period, except from 30 to 40, the male rates were the higher.

History of Chief Diseases.

Cholera.

There is nothing new to record bearing upon the microbial origin of cholera ; but allusion may be made to the connection established by Dr. E. Klein between the bacillus enteritidis sporogenes discovered and named by him in 1895* and some cases of cholera *nostras*. The bacillus is an anaërobic microbe, probably derived primarily from excrement and widely distributed in nature. It is particularly abundant and virulent in animal excreta and substances contaminated therewith, so that Dr. Klein has come to look upon the discovery of its presence in water as a more trustworthy criterion of direct fæcal pollution than the presence merely of bacillus coli.† Milk forms an exceedingly favourable medium for the culture of bacillus enteritidis sporogenes ; and, although the virulency of the microbe varies, the spores are frequently to be found in milk exposed for sale in London, even after the milk has been subjected to the ordinary trade process of "sterilization." Dr. Klein took a sample from a bottle of "pure sterilized milk," heated it to 80° C. (176° F.) for 15 minutes, and then incubated it anaërobically at the body temperature, when it yielded a pure culture of the virulent bacillus. Dr. Klein states, however, that the spores are destroyed by direct boiling in from three to five minutes.

The experience of the year teaches little that is new in the prevention and treatment of epidemic outbreaks of cholera in India. The old lessons are repeated ; cholera cannot be prevented by any single precaution, and no possible precaution should be omitted ; when the disease appears in epidemic form, prompt movement, intelligently carried out, is the most effective check.

The experience of the North-Western Provinces is encouraging, for it serves to show that even in a year of famine, well-devised measures for preventing the occurrence and checking the continuance of epidemics, carried out on a carefully organized plan, will not only save the lives of many relief workers, but will prevent their becoming a source of danger to the general public.

The two experiments in cholera prophylaxis by the disinfection of water-supplies and anti-cholera inoculation, to which allusion was made in this Report for 1896, were continued during 1897.

The disinfection of wells by means of permanganate of potash was practised systematically in most provinces, and the results are generally considered to have been satisfactory, although, in view of the fact that it is impossible to say that the disease would not have ceased in any case, and the difficulty in disinfecting every source of water-supply, it is very hard to obtain evidence of a conclusive character. The only circumstantial account of the effect of the measure is to be found in the Bengal Sanitary Report. The Civil Surgeon of Lohardaga carefully recorded the result of the disinfection of four wells in the town of Ranchi. In each case after the disinfection of the well only one case of cholera occurred among the people using the water.

In the North-Western Provinces and Oudh permanganate of potash was used to purify the wells in relief camps, not only in the presence of cholera, but whenever there was any

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* Report of the Medical Officer of the Local Government Board, 1895–96, Appendix B–1.

† Report of the Medical Officer, 1897–98, p. xx. and Appendix B–1.

doubt regarding the quality of the water. The Sanitary Commissioner thinks there can be no doubt about the utility of the proceeding, but states that experience shows that if it is to be effective it must be practised every three or four days.

In the Central Provinces the disinfection of water-supplies was generally used, and most of the Civil Surgeons considered it beneficial, although there is some divergence of opinion among them. The Civil Surgeon of Mandla, where cholera was exceedingly severe, states that, "the use of the permanganate of potash never failed to control and "quickly stamp out the most virulent epidemic." On the other hand, the Civil Surgeon of Bilaspur states that wells were disinfected, "but with no apparent effect on the course "of the disease," which he suggests may be explained by the impossibility of disinfecting the great number of sources of supply. The Sanitary Commissioner, in summing up the evidence, writes, "The application in fact of permanganate of potassium to ordinary "unprotected water-supplies does not, it may be definitely stated, much or materially "diminish the risk of cholera infection in epidemic times."

In Berar the general opinion was that the use of permanganate had a beneficial effect, but it is pointed out that the number of wells in a Berar village or town renders systematic disinfection almost impossible.

In Madras the purification of water-supplies, when small, by permanganate of potassium, and when large, by lime or alum, was freely practised. Although the people sometimes objected to the red colour produced by the permanganate, in most districts the people as well as the medical officers regard its use with favour.

Anti-cholera inoculation.—Preventive inoculation against cholera was carried on in Bengal throughout the year, and 10,950 persons were operated on, mostly coolies on their way to the tea districts of Assam and Cachar. No complete statistics regarding the efficacy of the inoculations have been obtained, but such facts as were recorded are in favour of inoculation. Cholera was extraordinarily prevalent in 1897 among the coolies on their way to the labour districts in Assam and Cachar, and it is possible to compare roughly the mortality among the inoculated and uninoculated among the general body of immigrants on their way to the former. Confining the calculations to deaths which occurred between the ports of embarkation and the tea gardens, it appears that the general cholera death-rate was 16·7 per 1,000, and that the death-rate among inoculated coolies was 4·9 per 1,000. There are probably other circumstances besides inoculation to be taken into account; but it seems likely that, in the future, the data will be more complete, for the Chief Commissioner of Assam has prescribed a half-yearly return to be prepared by managers of tea gardens, in which will be shown the deaths from cholera on the gardens among uninoculated persons and among inoculated persons, (1) within six months, (2) between six and twelve months, (3) between one and two years, and (4) after two years from the date of inoculation.

It was stated that a large number of the men of the Shropshire Regiment, among whom there was a very severe outbreak of cholera at Sitapur in September, had been inoculated by M. Haffkine at Fort William in 1896. An examination of the medical history sheets, however, showed that if more had been inoculated, the operation was recorded in 27 cases only. The number of men at Sitapur when the epidemic began was 435; of these 65 were attacked and 41 died of cholera. Among the 27 inoculated men four were attacked and two died. So that among the uninoculated the percentage attacked was 14·9 and the case-mortality about 63 per cent., while among the inoculated the percentage attacked was 14·8 and the case-mortality 50 per cent.

Anti-cholera inoculation was carried out during the epidemics in the jails at Hazaribagh and Ranchi, but although none of the inoculated were attacked, it does not seem that anything can be proved regarding the protective effect of the proceeding. The medical officer of the jail at Ranchi found that of 335 inoculated 31·3 per cent. gained weight after the operation, 45·3 lost weight, and 23·3 neither lost nor gained.

The total number of deaths registered as due to cholera throughout India and Burma in 1897 was 555,035, as compared with 471,779 in 1896. During the last twenty years the cholera mortality of 1897 has been exceeded on only three occasions; in 1877, when the number of deaths was 635,977, including the enormous total of 357,430 deaths in Madras; in 1891, when the deaths numbered 582,081; and in 1892, when the total reached 727,493. Deaths from cholera were less numerous in 1897 than in the preceding year in Bengal, the North-Western Provinces and Oudh, the Punjab, Berar, Rajputana and Central India; in all the other provinces deaths were more numerous than in 1896; and in Madras, Bombay, the Central Provinces and Assam the mortality was quite exceptional.

The following statement shows the total numbers of deaths ascribed to cholera in every province in India in each year from 1877 onwards :—

Statement showing the deaths from Cholera in the different Provinces in India from 1877 *to* 1897.

YEAR.	Bengal.*	Assam.	N.-W.P. and Oudh.	Punjab.	Central Provinces.	Berar.	Rajputana.	Central India.	Bombay.	Hyderabad.	Madras.	Mysore.	Coorg.	Lower Burma.	Ajmere-Merwara.
1877	155,305	11,377	31,770	29	3,418	842	60	926	57,228	7,414	357,430	2,902	‡	7,276	11
1878	95,192	6,732	22,221	215	40,985	34,306	2,393	8,047	46,743	6,696	47,167	723	49	6,759	210
1879	130,363	17,415	35,892	26,135	27,575	223	918	2,734	6,937	6	13,296	14	—	1,828	120
1880	39,643	2,803	71,546	274	330	1	—	299	684	—	613	25	—	2,638	3
1881	79,180	5,010	25,865	5,207	9,140	3,404	197	581	16,694	1,721	9,446	25	3	5,239	16
1882	182,352	21,055	89,372	39	11,932	3,573	1,327	1,562	7,904	150	23,604	893	31	7,177	289
1883	90,439	14,908	18,160	190	16,235	27,897	797	1,740	37,954	1,947	36,284	124	—	2,185	87
1884	134,421	22,276	30,143	614	149	87	1,297	1,018	13,804	2,479	75,476	330	—	5,515	227
1885	173,767	7,753	63,457	1,936	21,898	3,683	1,615	4,624	37,287	1,387	58,109	2,677	—	7,685	100
1886	118,368	20,188	34,565	12	16,679	976	173	290	167	499	12,417	10	—	4,027	767
1887	172,578	7,941	200,628	8,804	12,576	14,396	2,612	8,868	25,711	2,831	28,359	832	3	2,649	384
1888	111,391	9,693	18,704	14,938	921	305	32	191	36,500†	2,057	58,677	1,015	2	15,982	13
1889	171,103	18,288	48,494	2,838	52,588	10,925	6,923	3,344	32,431	1,128	76,020	1,590	9	3,240	55
1890	145,885	15,396	80,295	3,401	4,787	847	2,746	3,132	3,259	—	35,288	1,326	5	1,076	418
1891	229,575	23,882	169,013	10,107	21,312	7,958	2,946	13,474	17,850	3,102	98,773	1,204	7	2,400	732
1892	259,398	21,552	194,886	75,959	39,972	2,030	26,760	8,384	42,900	53	79,033	5,497	58	6,208	2,3 2
1893	126,976	21,849	12,154	639	557	1,188	314	127	18,853	165	32,209	680	9	2,393	3
1894	236,150	13,497	178,079	113	7,043	3,452	2	5,210	33,588	1,862	42,289	328	8	7,428	—
1895	177,087	18,962	51,562	549	15,506	11,919	1,049	6,043	8,890	467	21,172	2,334	—	5,150	289
1896	226,824	17,042	69,147	5,146	52,985	12,264	3,797	15,766	35,404	525	47,847	2,100	49	2,959	12
1897	196,247	33,240	44,208	622	57,131	10,122	1,496	13,202	57,109	1,039	143,445	4,248	106	8,538	19

* Excluding Calcutta from 1877 to 1892. † Including four deaths, the monthly distribution of which is not known.
‡ Statistics not available.

In the following statement the season distribution of the disease in the different provinces is exhibited. It will be observed that in the country generally, August, June and July, in the order given, were the months of greatest prevalence ; while, as in 1896, the mortality was least in February, January and November :—

Statement showing the Deaths from Cholera registered in the different Provinces by Months during the year 1897.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1897.	1896.
Bengal	5,597	7,154	25,328	30,028	20,908	18,654	19,331	24,879	10,469	6,990	14,023	12,786	196,247	2·76	3·19
Assam..	1,266	1,408	3,108	3,320	4,209	1,784	1,484	1,180	1,640	3,227	5,769	4,755	33,240	6·62	3·39
North-Western Provinces and Oudh.	22	204	1,314	2,256	2,968	7,317	7,534	7,978	6,721	5,495	1,602	797	44,208	·94	1·47
Punjab	—	—	—	—	—	13	175	150	193	91	—	—	622	0·03	0·25
Central Provinces..	283	1,279	3,443	6,334	15,642	21,125	5,243	1,960	1,200	390	181	51	57,131	6·01	5·58
Berar	77	59	144	808	1,676	1,029	1,228	4,026	977	100	—	—	10,122	3·56	4·31
Lower Burma ..	255	733	1,515	1,462	1,118	714	1,327	795	316	112	97	94	8,538	1·89	·66
Madras Presidency	19,721	8,285	5,953	4,165	6,117	10,613	15,899	20,688	14,130	13,037	8,459	16,378	143,445	4·38	1·46
Bombay	1,225	992	1,745	4,163	9,897	9,635	14,749	9,661	3,009	1,520	392	121	57,109	3·03	1·88
Ajmere-Merwara ..	—	—	—	—	6	1	1	9	1	1	—	—	19	·04	·02
Coorg	—	—	—	—	41	54	5	6	—	—	—	—	106	0·61	0·2
Mysore	627	372	293	418	652	447	260	183	481	341	155	19	4,248	·88	0·43
TOTAL ..	29,073	20,486	42,843	52,954	63,324	71,386	67,234	71,615	39,137	31,304	30,678	35,001	555,035	2·55	2·17

In the next statement the millesimal death-rates from cholera in the different provinces are contrasted with each other, and with the quinquennial averages ; urban is compared with rural mortality ; the highest mortality in any single district and in any one town in each province is shown ; and the months of greatest prevalence in each province as indicated by the number of deaths are named :—

Province.	Mortality in 1897.	Mean mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in any one district, excluding towns.	Maximum mortality in any one town.	Month of maximum prevalence.
Bengal	2·76	2·89	3·76	2·71	13·26	9·61	45·56	April.
Assam	6·62	3·70	15·44	6·43	18·42	16·89	62·08	November.
North-Western Provinces and Oudh.	·94	2·16	1·38	·91	5·7	3·39	9·40	August.
Punjab	0·03	0·80	0·13	0·02	·082	0·50	3·98	September.
Central Provinces ...	6·01	2·44	4·87	6·11	17·7	11·59	37·12	June.
Berar	3·5	2·2	6·8	3·1	10·57	5·0	24·8	August.
Lower Burma ...	1·89	1·07	2·88	17·4	10·40	5·14	35·52	March.
Madras	4·4	1·3	5·0	4·3	23·0	12·4	28·5	August.
Bombay	3·03	1·48	2·26	3·14	13·8	9·16	26·63	July.
Ajmere-Merwara ...	·04	·98	·11	·01	·54	·21	·19	August.

Bengal.—The total number of deaths registered as due to cholera in Bengal was 196,247. The death-rate from this disease was 2·76 per 1,000, much less than the death-rate of 1896, which was 3·19, and ·13 below the average of the previous five years. As usual, every district in the province suffered, and in most of the districts cholera was present throughout the year. In spite of the lower death-rate the percentage of villages attacked was higher than in 1896—13·26 as compared with 12·23. In 26 districts the cholera death-rates were below the average and in 20 above it. Cholera was far more prevalent than usual in all the districts of Chota Nagpur, and much less prevalent than usual in the districts of the Patna Division. The highest district death-rates were 9·57 per 1,000 recorded in Puri, 8·35 in Chittagong, and 8·02 in Lohardaga. Puri always suffers more or less severely from cholera. Great numbers of pilgrims pass through it along the pilgrim road on their way to attend religious festivals, and these people are, from the conditions of their pilgrimage, peculiarly liable to cholera. In 1897 the district was famine-stricken. Cholera broke out epidemically in May in two *thanas* which were severely affected by the famine, and did not abate until August, after nearly 4,000 deaths had occurred. In the district of Chittagong the cholera death-rate was nearly four times the average. There were two outbreaks, the first in April, May and June, attributed by the Civil Surgeon to the concentration of the polluted water-supply on account of drought ; the second in November and December, but chiefly in the latter month, when, owing to the rise in the price of the ordinary articles of food, the people were subsisting largely on dried fish. This dried fish, although bad smelling, may, it seems, be consumed in moderate quantities with impunity, but when it was taken into use as a substitute for the every-day diet of rice and *dál*, it gave rise to diarrhœa and predisposed the consumers to be attacked by cholera. Particulars regarding the most unusual cholera mortality in Lohardaga are not given. The district is not included in the list of those seriously affected by famine, but the neighbouring districts of Palamau and Manbhum, where the cholera death-rates were also very high, are included. The lowest cholera death-rates were registered in the district of Darbhanga, ·14 per 1,000 against a quinquennial mean of 3·27, Jalpaiguri ·30, Saran ·35 and in Muzaffarpur ·35, against a mean in that district of 4·38.

Cholera was more fatal in the towns than in the districts, the millesimal death-rates having been 3·76 and 2·71. Only ten towns, including Darjeeling, Dinajpur, Motihari, Lalganj and Roserha, escaped altogether, and in very many of the towns the rates were

very high. The towns in Chota Nagpur suffered especially, and enormous death-rates were registered in Daltonganj, 23·10 per 1,000, Hazaribagh, 25·07, and Lohardaga, 45·56.

In the province as a whole, the greatest mortality occurred in April, March and August, and the least in January, October and February. The incidence of mortality as usual varied in different localities. In Bengal proper, cholera was most severe in April, March and June; in Bihar, in August, June and July; in Orissa, in July, June, November and August; and in Chota Nagpur, in August, July, September and June.

Thirteen cases and 11 deaths from cholera occurred among the European seamen in the Port of Calcutta, as compared with 23 cases and 18 deaths in 1896. Among the native floating population there were 116 deaths, as compared with 156 in 1896.

Assam.—The cholera mortality in Assam in 1897 was enormous; the number of deaths rising from 17,042 in 1896 to 33,240, and the death-rate from 3·39 to 6·62 per 1,000, as compared with a quinquennial average of 3·70. Although the cholera death-rate was nearly double the average in Cachar, it was a little below it in Sylhet, and the population of the latter being about six times as large as that of the former, the average death-rate in the Surma Valley was but little in excess of the quinquennial average—3·79 per 1,000 as compared with 3·58. In the selected areas of the Khasi and Jaintia Hills cholera was a little less prevalent than usual. The enormous increase in the cholera death-rate then, was due to the prevalence of the disease in the Brahmaputra Valley. Even there the death-rates were lower than usual in Nowgong and Lakhimpur, but in all the remaining districts the rates were very high, and in Kamrup (17·48), Goalpara (10·35) and Sibsagar (9·75) they were enormous.

The seasonal distribution of the disease was not that of an ordinary year. In the Surma Valley cholera is generally most fatal in the cold weather months; in 1897 the death-rates were less than the average in the months of November and December, and less than half the average in January, whereas in March, April and May the rates were rather more than twice the average. In the Brahmaputra Valley there are two seasons of cholera prevalence, April, May and June, and November and December; in 1897 the monthly rates were all far above the average and the maxima occurred earlier, in March, April and May, and in October, November and December.

In the towns the cholera death-rate averaged 15·44, against 6·43 in the country, but it must be remembered that the towns are small, and that the rates were raised by the deaths of immigrants at the coolie depots. Thus, the highest urban cholera death-rates were 62·08 in Tezpur, and 58·86 in Dhubri, but in the former 233 out of 249 deaths, and in the latter 216 out of 284, occurred among immigrants. A high rate of 13·56 per 1,000 in Silchar is accounted for in the same way. In Barpeta, where the cholera death-rate was 52·59 per 1,000, 504 out of the 625 deaths occurred in August, and the severity of the outbreak is attributed by Colonel Stephen to pollution of the water-supply produced by disturbances caused by the earthquake.

Although the cholera mortality of the year would have been heavy in any case, there seems to be every reason to believe that the total mortality was greatly enhanced as a result of the suffering and privation to which the people were exposed by the floods which resulted from the earthquake.

The mortality among the immigrant coolies was entirely exceptional, no less than 474 dying on steamers going up the river and 934 in the depôts after landing.

The mortality among the coolies on the tea gardens, calculated on their population in 1891, was 6·83, against 6·66, the average among the general population of the districts in which the gardens are situated; but, as pointed out by the Chief Commissioner, the population of the tea gardens has increased by 30 per cent. since the census, and, calculated on the actual populations, the cholera death-rate on tea gardens was 4·91 per 1,000. Taking the actual number of deaths, in the districts, excluding the tea gardens, the number of deaths rose from 14,885 in 1896 to 30,081 in 1897; on the gardens the number of deaths rose from 2,112 to 3,108. Roughly, the mortality among the general population was doubled, while the deaths of tea garden coolies increased in number by one-half.

North-Western Provinces and Oudh.—In a year of famine, when the general health of the people was reduced and great numbers of the very poorest were gathered together on relief works, it might be expected that the mortality from cholera would have been exceptionally great. But this was not the case. The mortality was less than half the average. Time after time, cholera appeared in epidemic form among the relief-workers, but the measures adopted never failed to check the disease. These measures were, " the

" careful preservation of the purity of the water-supply, the prompt removal of the people " from the infected area, and the breaking up of large bodies of people into smaller " manageable units."

The total number of deaths was 44,208, equal to a death-rate of ·94 per 1,000, as compared with 1·47 in 1896, and an average of 2·16 for the five years preceding that under report. In no district was the cholera death-rate very large; the highest rates being recorded in Pilibhit (3·21), Jalaun (3·03), Hamirpur (2·86) and Banda (2·72); in nine districts the rates were less than ·10 per 1,000, and in no less than seven of these the numbers of deaths were under ten, three of them, Almora, Garhwal and Muzaffarnagar, escaping altogether. The rural cholera death-rate was ·91, against 1·38 in the towns. Twenty-eight of the latter entirely escaped, and in only a few were high cholera death-rates recorded—Sandila (9·40), Ramnagar (9·10), Fatehpur (8·42), Barhaj (7·00), Kalpi (5·58), Azamgarh (5·40), Mubarakpur (5·29) and Gorakhpur (4·45).

There was but little cholera in the provinces in January and February; a rapid rise in March was followed by a gradual rise till June, when there was another sudden rise; rates rose gradually to a maximum in August, and gradually fell until October, when the fall to the end of the year was rapid.

Punjab.—Cholera was present in only five districts, and the total number of deaths recorded as due to it in the Punjab was 622, equal to a death-rate of ·02 per 1,000, as compared with ·25 in 1896, and ·80 the quinquennial mean. Of the total, 538 deaths occurred in Hissar, 61 in Gurgaon, 15 in Rawalpindi, 6 in Gurdaspur and 2 in Lahore. The average district rate was ·02, as compared with ·13 in the towns. The disease appeared in only five towns, Hissar (cholera death-rate 3·98 per 1,000), Hansi (2·63) and Bhiwani (2·37) in the Hissar district, Rewari (2·18) in Gurgaon, and Lahore (·01). All the deaths occurred between June and October, inclusive, the largest number being registered in September.

Central Provinces.—The cholera returns of the Central Provinces in 1897 afford a remarkable contrast with those of the North-Western Provinces and Oudh; in both provinces famine was present, but while in the latter the cholera mortality was that of an ordinary year, in the former it surpassed those of all previous years, except 1869, when the prodigious rate of 10·50 per 1,000 was computed.

The total number of deaths registered was 57,131, equal to a death-rate of 6·01 per 1,000, as compared with 5·58 in 1896, 2·44 the quinquennial mean, and 5·96 in 1889, another year of extraordinary cholera prevalence. In every district, except Burhanpur, the cholera death-rate was higher than the district mean, and in twelve of the twenty districts the rates were higher than they were in 1896. Cholera deaths were returned from 221 of the 233 circles of registration, every circle in 12 of the districts being attacked. As in 1896, the greatest mortality was registered in Mandla, and the least in Burhanpur; but while the rate in Mandla fell from 15·75 per 1,000 to 11·62, the rate in Burhanpur rose from ·68 to 73. The next highest rates were 10·04 and 9·87 recorded in the adjoining districts of Raipur and Bilaspur; while the next lowest were 1·96 in Jubbulpore, which marches with Mandla, and 2·93 in Wardha.

The average millesimal cholera death-rate in rural areas was 6·11, far higher than the average urban rate of 4·87, but many of the smaller towns suffered in an extraordinary degree. The highest rates were 37·12 per 1,000 registered in Drug, in Raipur, 35·49 in Sironcha, in Chanda, and 24·22 in Seoni. Ten towns, among them Burhanpur and Jubbulpore cantonment, escaped altogether, and the rate in Jubbulpore city was only ·29. The comparative immunity enjoyed by Raipur town in 1896, when the death-rate in the town was rather less than a third that of the district, was not continued; in 1897 there were 111 deaths in the town and the death-rate, 4·67, was just under half that of the district. It seems, however, that the general water-supply of the town, to the good quality or which the relatively low death-rate in 1896 was ascribed, was bad in 1897.

The death-rate increased steadily from January (283 deaths) to April (6,334); in May there was a rapid rise (15,642), and the maximum (21,125) was reached in June; in July there was a very rapid fall (5,243), which was maintained until December when the minimum (51) was reached. The greatest mortality in most of the districts was recorded in June, but in Narsinghpur and Burhanpur the largest numbers of deaths occurred in April, in Murwara, Hoshangabad, Balaghat and Nagpur in May, and in Chanda in July. At the beginning and end of the year many districts were free from the disease, and even in the three months when the epidemic was most severe, two districts were unaffected. In Burhanpur there were only two fatal cases in May and none in June or July; and in

Chhindwara no death was reported in April. The average death-rate of males (6·47) was considerably higher than that of females (5·56); but in Saugor, Narsinghpur, Chhindwara, Damoh and Betul the female rates were the higher, the reported deaths of females being actually more numerous than those of males in the first three of these districts.

Berar.—In a year of famine and distress it was to be expected that there would be a great number of deaths from cholera in Berar, a province where the disease is an annual visitant. The number of deaths was large, 10,122, but it was less than in either 1896 or 1895, when 12,264 and 11,919 cholera deaths were recorded, and the aggregate of these three years is almost exactly equal to the appalling total registered in 1878, the last year of famine, when 34,306 deaths were ascribed to cholera.

The death-rate in 1897 was 3·5, against 4·3 in 1896, and 2·2 the quinquennial mean. The highest district rates were 5·6 and 4·4 per 1,000, recorded, respectively, in Akola and Amraoti, and the lowest 2·6 and ·7 in Basim and Wun, where the highest rates of the preceding year were registered.

In rural areas the average cholera death-rate was 3·1 per 1,000, less than half the urban rate of 6·8. In some of the towns the rates were excessive, particularly in Talegaon (24·8), Karanja (20·6) and Kolapur (19·6), in Amraoti, in which district are located also the only four towns that escaped altogether—Ner Pinglai, Nandgaon Pett, Pusla and Buroor. The towns of Pusla and Buroor have escaped cholera altogether during the last three years, but in 1894 the cholera mortality in them was almost the highest in the province.

The seasonal distribution of the disease was normal; slight during the earlier months, rising through the hot weather to a maximum in August, and then rapidly declining to disappear altogether with the onset of the cold weather in November.

Madras.—Cholera was exceedingly prevalent and fatal in Madras in 1897, and no less than 143,445 deaths from it were recorded, equal to a death-rate of 4·4 per 1,000, as compared with 1·5 in 1896, and 1·3 the mean of the quinquennium. The two districts that suffered most were Ganjam in the extreme north-east and Malabar in south-west. In these districts the death-rates were, respectively, 12·5 and 10·4 per 1,000. In both districts scarcity was severe, and the district medical officers state that diarrhœa simulating cholera was extremely prevalent owing to the people eating unsuitable food. In Malabar the sex distribution of the mortality was peculiar. In that district, as in most of the coast districts of Madras, there is an excess of females in the population; but in Malabar alone, not only was the actual number of females who died larger than the number of males who died of cholera, 14,616 as compared with 12,917, but the female cholera death-rate was much the higher, 11·0 against 9·9. The next highest death-rate, after that recorded in Malabar, was 7·5 per 1,000 in Tanjore, and this was followed by 6·0 in Madura and 5·9 in Anantapur. The lowest rates were ·5 and ·3 recorded, respectively, in Nellore and Madras.

In rural areas the average death-rate was 4·3 per 1,000, against 5·0 per 1,000 in the towns. Only two of the latter escaped altogether, namely, Ravadrug and Rajahpalaiyam, but in nine, including St. Thomas' Mount, Ootacamund and Mangalore, the numbers of fatal cases were 5 or less. The highest urban rates were 28·5, 23·6 and 23·1 per 1,000 registered, respectively, in Cannanore, Parlakimedi and Calicut, and in no less than seventeen other towns rates in excess of 10 per 1,000 were recorded.

The disease was exceedingly prevalent in January (19,721 deaths), it decreased rapidly in February, and then gradually declined to a minimum in April (4,165); the number of deaths then gradually rose until August (20,688), when the maximum was reached; the numbers again declined until November (8,459), and then suddenly rose again in December (16,378).

Coorg.—Although the cholera death-rate in Coorg was only ·61, the disease was unusually prevalent there as compared with past years; there were 106 deaths, against an aggregate of 150 in the last ten years. Only nine deaths occurred in the towns, all in Virajendrapet, where the death-rate from cholera was 2·02 per 1,000.

Bombay.—The number of deaths registered as due to cholera in Bombay was 57,109, a number which has not been nearly equalled since the famine year, 1877, when the number of deaths from cholera was 57,228. In its broader features the distribution of cholera in 1897 resembles the distribution in 1877. In both years Sind was free from the disease, and the districts of Gujarat suffered comparatively little; but in 1897 the districts of Kolaba, Khandesh, Ahmednagar, Nasik, Poona, Sholapur and Satara suffered more severely

than they did in 1877, while the remaining districts, although the disease was very prevalent in them, suffered less.

The death-rate in 1897 was 3·03 per 1,000, as compared with 1·88 in the previous year, and a quinquennial average of 1·48. As has been indicated, the province of Sind was practically free from the disease, only one death occurred in the town of Karachi in September. No fatal case was reported in Ahmedabad, only seven were reported in Panch Mahals, and ten each in Broach and Kaira. The highest district death-rates were registered in Satara (9·03), Poona (8·62), and Belgaum (7·41), and high rates, over 4 per 1,000, were recorded in Bijapur, Sholapur, Kolaba, Ahmednagar and Nasik.

The average cholera death-rate in rural areas was 3·14 per 1,000, as compared with 2·26 in the towns. Twenty-two of the latter escaped entirely, and in twelve others, including Surat (1) and Broach (3), the numbers of deaths recorded were less than ten. By far the highest urban death-rate from cholera was 23·63 per 1,000 in Nasik, where 650 deaths occurred. In Pandharpur the death-rate was 12·33, in Kalyan 9·68 and in Junnar 9·58.

Nearly as the local incidence of the epidemic of 1897 resembled that of 1877, there is not much in common in the monthly distribution of the disease in the two years. In the earlier epidemic the disease prevailed steadily throughout the year, reaching its maximum of 8,309 deaths in June, and then gradually declining to a minimum in December. In 1897 the vast majority of the deaths occurred between May and August, the maximum of 14,749 being reached in July. As in 1877, the smallest number of deaths was recorded in December.

Burma.—The number of deaths from cholera registered in Lower Burma was 8,538, and it is necessary to go back to 1888 and 1873, when 15,982 and 8,109 deaths were, respectively, recorded, to find this total exceeded or nearly equalled. The death-rate was 1·89 per 1,000, as compared with ·66 in the previous year, and 1·07 the quinquennial average. The disease was most severe in the deltaic districts of Myaungmya (death-rate 5·10 per 1,000) and Thongwa (4·41), in Thayetmyo (3·72) and in Tharrawaddy (3·28). The southern districts of Tavoy and Mergui escaped entirely, and Sandoway, although it is bordered by Thayetmyo (3·72), Prome (1·76), Henzada (1·72) and Bassein (1·84), in all of which the disease was more fatal than usual, is reported to have been exempt. The other two districts of the Arakan division, Kyaukpyu (·12) and Akyab (·63) were, however, unusually free from cholera.

The urban cholera death-rate was 2·88, as compared with 1·74 per 1,000 in rural areas. In six towns no death from cholera was reported, and in other five the number of deaths was less than six ; but the rates were upwards of ten per 1,000 in five towns, the highest being 35·52 and 12·57 recorded, respectively, in the small towns of Zigon and Myanaung, where the populations are so small that a comparatively small epidemic gives an enormous death-rate.

The disease was present in ten districts out of eighteen in January, and the number of deaths reached the maximum in March ; in April and May there was a slight decline, which became considerable in June ; in July the number of deaths again rapidly increased, and in August almost as rapidly decreased, after which there was a steady fall to the end of the year, the minimum being registered in December.

Summary of cholera registers.—The following paragraphs have been compiled from the official reports of the occurrence of cholera among European and native troops and among prisoners. It is apparent that, owing to the press of more urgent work, the materials for these reports are not always collected at the time ; and the reports, in consequence, too often lack precision, even when they have been drawn up by the same medical officer who was in charge at the time of the outbreak.

Cholera occurred among European troops at 23 different stations. There were in all 132 cases and 85 deaths, a case-mortality of 64·39 per cent. In eleven instances the attacks were single, and seven of these single cases ended fatally. Three of the single cases, of which two were fatal, occurred in regiments on their way to the front. All the outbreaks were small, except at Sitapur, where there was a very severe epidemic among the men of the 1st King's Shropshire Regiment.

Among native troops the disease appeared in 34 different stations, and among 43 bodies of men. Excluding the cases of three European officers, all of whom died, there were 201 attacks and 121 deaths, a case-mortality of 60·19 per cent. Of the total, 100 cases and 58 deaths—case-mortality 58 per cent.—occurred among regimental followers. There were 13 single attacks, and 10 of these ended in death. The vast majority of the outbreaks were slight, and in only four instances were there upwards of 10 cases.

Cholera appeared in 82 jails during the year, and in 16 of them on more than one occasion. There were in all 975 seizures and 412 deaths, equivalent to a case-mortality of 49·43 per cent. Although cholera was so widespread among the prison populations, only the Punjab, Berar and Coorg escaping, the majority of the outbreaks were slight. In 24 jails single cases only occurred, but 17, or 70·83 per cent., of these cases were fatal. In the following jails the outbreaks were very severe: Coimbatore, 280 cases and 113 deaths, Rajahmundry, 202 cases and 75 deaths, Thana, 63 cases and 37 deaths, Moulmein, 63 cases and 37 deaths, and Hazaribagh, 26 cases and 19 deaths.

Diarrhœa seems to have been very seldom specially prevalent at the time that cholera occurred. Among European troops it was unusually prevalent on only two occasions, namely, at Jhansi and Nusseerabad ; and among native troops on no single occasion. At the time of the outbreaks in the jails at Purulia, Hazaribagh, Rajmahal, Jaunpore, Rajahmundry (during each of the three outbreaks) and Bassein, an unusual prevalence of diarrhœa was noted.

The statement below shows, as nearly as possible, the numbers of buildings occupied by the various bodies of men attacked by cholera, and the proportion which furnished cases of the disease :—

Communities.	Number of buildings occupied by bodies of men attacked.	Number of buildings which furnished cases.	Percentages of buildings which furnished cases.
European troops	572	52	9·29
Native troops and followers ...	12,549	153	1·22
Prisoners	879	179	20·36

Cholera occurred during all conditions of weather, but no special relation between particular meteorological conditions and the occurrence of the disease was established.

In most instances in 1897 cholera was prevalent throughout the districts in which the bodies of men attacked were located, so that evidence of importation, in the sense in which the term is used here, namely, the bringing of cholera from a place where it existed to a place where it did not exist, and its subsequent spread in the latter, could not be adduced.

In only six instances, when European troops suffered, the presence of cholera was not reported in the surrounding villages. These instances are the following :—At Fyzabad, a man was seized two days after his return from Calcutta where he had been on escort duty ; the man died, but the disease did not spread. At Muttra, a man who was in hospital and another living in a tent were attacked on the same day : both men had been eating country bacon, and had no other circumstance in common ; both died, but the disease did not spread. Two men of the 1st Dorsetshire Regiment suffering from cholera were removed at Umballa from the troop train carrying the regiment to the front : one man died and the other recovered ; and no other case occurred in the regiment, which was detained at Umballa for eleven days, or among the troops in that station.

The next statement shows the numbers of persons who were in attendance of one kind or another on cases of cholera, with the numbers and percentages attacked :—

Communities.	Number of cases of cholera treated.*	Attendants.		Percentage of attendants attacked.
		Number.	Number of these attacked.	
European troops	128	269	1	0·37
Native troops and followers	182	449	5	1·11
Prisoners	970	847	30	3·54

* Cases not treated in hospital are excluded when the number of attendants is unknown.

A European orderly, one of nineteen persons in attendance on two cases at Fort Allahabad, was seized four days after the second case of cholera was admitted to hospital. The medical officer attributed the man's attack to neglect of the precautions he had been instructed to take.

Of the five persons attacked while in attendance on native soldiers and followers, two belonged to the regiment at Sirdarpore and a third was the sister of a lascar at Raipur ; these attacks were attributed by the medical officers to neglect of precautions. The fourth case, that of a sweeper at Bolarum, was not ascribed to attendance, but to the man's wandering in an intoxicated condition in the *bazaar* where cholera was prevalent. The fifth case was that of a sowar at Hingoli, who was in attendance on his child ; but the medical officer did not think the attack was due to the attendance.

Not included among attendants attacked, is the case of the medical officer of the 1st Madras Lancers. The regiment was in cholera camp, at Sangana Kulli, and the epidemic had apparently ceased on the 18th October. On the 30th the medical officer and two grass cutters were attacked and died. The reporting officer writes, " His attack was not " due to attendance on any of the cases, none having occurred in camp between the 18th " October 1897 and the 30th October 1897."

The large number of attendants who suffered in the epidemics among prisoners is in part due to the unusual prevalence of cholera among the people generally. In two or three cases the attacks might fairly be attributed to attendance, but medical officers sometimes appear to forget that attendance on cases of cholera does not afford immunity from the incidence of the disease, if it is specially prevalent in the locality. For instance, at Coimbatore, 13 attendants were attacked, and the medical officer concludes that their attacks were due to " close attendance on the affected." In the epidemic there were 280 cases among a population 1,054 persons. Omitting the medical staff, all of whom escaped, there were 91 convict orderlies of whom 13 got cholera. That is to say, out of the general body of 963 prisoners, 267 were attacked, or 27·73 per cent., while of 91 orderlies 13, or only 14·29 per cent., were attacked.

Except at Kirkee, where the method in use for the removal of waste water is condemned, no defect in the general sanitation is noted in connection with any outbreak among European troops.

Beyond scantiness of the water-supply in several instances, overcrowding at Shillong, and defective drainage at Sirdarpore, few complaints regarding the sanitary surroundings of the native regiments in which cholera occurred are made.

In the jail reports complaints are more frequent, principally of overcrowding and defective drainage ; in some instances the water-supply seems to have been bad ; while in a few cases the general sanitation of the jail seems to have been at fault.

The effect of moving European troops, when this remedy was required, was invariably beneficial not only in respect of the cessation of cholera, but as regards the general health.

The movement of native troops was always successful, and the effect on the general health was good. Prisoners were moved in very many instances, and with few exceptions with the best results, not only in checking cholera, but in improving the general condition. The general health of prisoners moved into camp was affected more or less injuriously by heat and glare at Minbu ; exposure to rain gave rise to dysentery at Hazaribagh ; and the chilly mornings and hot days set up dysentery among the prisoners camped out at Vellore.

Small-pox.

The deaths from small-pox in 1897 in the parts of India under registration numbered 167,318, or 25,875 more than in the preceding year, the ratio per 1,000 of population being 0·77 against 0·65. The increase in ratio affected six of the twelve provinces in the table ; but was much the greatest in the case of the North-Western Provinces and Oudh.

The mortality rose month by month from the beginning of the year up to its maximum in April, then sank month by month to its minimum in October, and, finally, rose again to the end of the year ; and in all the provinces the maximum was in the first half of the year, the minimum in the second. Of the total deaths of the year, 81 per cent. occurred in the first half, and 19 per cent. in the second. The months of greatest mortality were April, May, and March, and those of least mortality, October, November, and September. Each of the first five months had more deaths, and each of the last seven, fewer, than the corresponding months of 1896.

The following shows the mortality from small-pox in the different provincial registration areas of India in 1897, month by month :—

Statement showing the deaths from Small-pox registered in the different Provinces by Months during the year 1897.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.		RATIO OF DEATHS PER 1,000 OF POPULATION	
													1897	1896	1897	1896
Bengal	1,360	1,710	3,477	3,576	3,541	2,056	1,061	920	504	311	512	627	19,655	13,388	0·27	0·19
Assam	515	561	603	1,016	855	650	343	247	155	111	133	231	5,420	5,444	1·08	1·08
North-Western Provinces and Oudh.	6,529	7,076	12,605	21,313	19,224	10,723	5,856	2,185	814	375	168	259	87,127	42,771	1·86	0·91
Punjab	3,420	2,124	1,789	1,729	1,909	1,643	1,293	675	416	303	383	393	16,077	45,084	0·78	2·19
Central Provinces	409	336	565	708	613	427	190	109	57	137	32	58	3,641	7,747	0·38	0·82
Berar	65	83	103	128	85	56	14	7	3	1	16	56	617	810	0·22	0·28
Lower Burma	120	155	196	265	272	202	181	150	96	88	84	144	1,950	1,669	0·43	0·37
Madras Presidency ..	1,612	1,954	2,117	2,262	2,773	1,931	1,479	1,331	968	1,014	1,354	2,883	21,678	9,410	0·67	0·29
Bombay „	378	676	952	775	384	186	106	73	37	58	43	167	3,835	6,443	0·20	0·34
Ajmere-Merwara	11	25	27	28	14	11	10	10	11	4	—	7	158	3,821	0·29	7·05
Coorg	—	7	3	8	3	2	3	9	12	6	6	—	59	18	0·34	0·10
Mysore	603	594	695	713	753	600	727	505	413	346	470	682	7,101	4,838	1·47	1·00
TOTAL	15,022	15,301	23,132	32,521	30,426	18,487	11,263	6,221	3,486	2,754	3,198	5,507	167,318	141,443	0·77	0·65

Bengal.—The number of deaths recorded as due to small-pox in Bengal in 1897 was 19,655, or 0·27 per 1,000, as compared with the 0·19 of the previous year, and with the average of the past ten years, which was 0·16. Most of the districts of the Patna, Orissa, and Burdwan Divisions had ratios above both the quinquennial and the decennial averages. The disease prevailed with epidemic intensity in Shahabad, Puri, and Gaya (ratios over 1 per 1,000). The Civil Surgeon of Shahabad thought that the severe prevalence might be due to the large number of unprotected people who came in search of work from other districts. The Civil Surgeon of Puri says that the infection came from the adjoining Madras district of Ganjam, and that the adult male population, who had either been inoculated in their childhood or had had the disease in a mild form before, were the chief sufferers. According to the Civil Surgeon of Gaya, almost all the deaths in the town of Gaya were among the unprotected and the outsiders, and the prevalence of the disease in the rural areas was due to the great opposition on the part of the people to vaccination. The number of district ratios not less than 1 per 1,000 was 3 ; not less than 0·5 per 1,000, 3 ; not less than 0·05 per 1,000, 20 ; and less than 0·05 per 1,000, 20. Only in the Jalpaiguri district was there no death. The urban death-rate was 0·26, as compared with a rural rate of 0·27. Mortality ratios of over 2 per 1,000 distinguished the towns of Bhadreswar and Serampore in the Hooghly district, and eight other towns had ratios of over 1 per 1,000. The number of deaths among children under 1 year of age rose from 1,924 in 1895 to 2,850 in 1896, and again to 4,351 in 1897 ; and among children 1 to 12 years of age, from 4,707 to 7,026, and again to 9,787 ; while the percentage of children's deaths in the total small-pox mortality of all classes rose from 50·92 in 1895 to 73·43 in 1896, but fell to 71·93 in 1897.

As in the preceding year, one non-fatal case occurred among the European seamen in the port of Calcutta ; while among the native floating population there were 8 deaths against 1 in 1896, the respective ratios being 0·31 and 0·03.

Assam.—In Assam there were 5,420 deaths registered during 1897, against 5,444, yielding a ratio of 1·08 per 1,000, the same as in 1896, against the 0·69 of the preceding quinquennium. The highest district death-rate, 5·10 per 1,000, representing 2,333 deaths, was recorded in Sibsagar ; Lakhimpur and Kamrup following with ratios over 2 per 1,000. One district had a ratio of over 1 per 1,000, one of over 0·5, and three districts ratios of not less than 0·05. Since a slight outbreak in 1881–82 very few small-pox deaths had occurred in the Nowgong district. The Civil Medical Officer reports that a brass-worker of the *Moria* caste was attacked with small-pox at Nachonipara in the Sibsagar district, and was brought in a boat, while suffering from the disease, to Moriagaon near Kuaritol, in the eastern portion of the Nowgong district, in the beginning of April 1897.

The disease afterwards spread in that village, in which about 130 persons were attacked and 13 died. From this village small-pox spread to neighbouring villages, and before the end of the year the greater portion of the Nowgong district was affected. As soon as the outbreak was reported, all arrangements were made to vaccinate unprotected persons in the affected villages, but in almost every case parents refused to allow their children to be vaccinated. The Sanitary Commissioner himself did all that he could personally. But "the people are," he says, "so bigoted that comparatively little vaccination was done "during the season; and as a large portion of the population is unprotected, the "probability is that small-pox mortality in Nowgong will be large in 1898." In ten towns there were no deaths from small-pox, and in the others the mortality ranged from 5·62 per 1,000 at North Lakhimpur to 0·14 at Sylhet, the provincial urban ratio being 0·50. On the other hand, the provincial rural ratio was 1·09, the district extremes being zero and 5·16. Among infants under one year of age there were 1,062 deaths, nearly 20 per cent. of the total; and among children between one and twelve, 2,846 deaths, near 53 per cent. of the total.

North-Western Provinces and Oudh.—The lowest recorded death-rate from small-pox in the twenty-six years 1871–96 was 0·04 from 1,968 deaths in 1895. But in 1897 there were 87,127 deaths from small-pox, giving a ratio of 1·86 per 1,000. The increase over 1896 was 44,356 in actual deaths, and 0·95 in the ratio. "This," says the Sanitary Commissioner, "is a considerable increase, and the explanation is possibly to "be found in the peculiar climatic conditions prevailing. Small-pox appears to be in "this country especially a disease of dry weather, its virulence increasing with "heat . . . It appears to have had little or no connection with famine: certainly "it did not particularly affect the distressed districts." The districts with mortality ratios not lower than 5 per 1,000 were Sultanpur, Jaunpur, and Bijnor; and there were five districts with ratios not under 4 per 1,000, one with a ratio not under 3 per 1,000, five with ratios not below 2 per 1,000, thirteen with ratios not less than 1 per 1,000, three with ratios not under 0·5 per 1,000, fourteen with ratios not under 0·05 per 1,000, and four with ratios under 0·05 per 1,000. There was no district without a small-pox death; and only 17 of the 97 principal towns escaped. The urban mortality was 0·62 as compared with 1·95 in the rural areas. Omitting the towns without mortality, the extreme urban ratios were, on the one hand, 8·31 at Nagina, 7·59 at Bilgram, 5·94 at Kiratpur, and on the other, 0·01 at Agra. Among infants under one year, 27,526 deaths occurred, against 14,410 in the previous year; and among children under 12 years of age but not under one year, 48,036, against 26,443. Again, the percentage of deaths of the former class of children to the total small-pox mortality of all classes of the population was nearly 32, against nearly 34 in 1896, and that of the latter class of children to the same, over 55, against nearly 62.

Punjab.—After the severe epidemic of 1896 small-pox greatly abated in the Punjab in 1897; the total number of deaths registered being 16,077 against 45,084, and the ratio per 1,000 0·78 against 2·19. As usual, says the Sanitary Commissioner, the lowest death-rate from small-pox was registered in Kangra, the best vaccinated district in the province. The Bannu district had a ratio over 3 per 1,000; the Hazara district, a ratio over 2 per 1,000; ten districts had ratios not below 1 per 1,000; eight, ratios not below 0·5 per 1,000; nine, ratios not below 0·05 per 1,000; and two a ratio below 0·05 per 1,000. The rural mortality was 0·81 and the urban 0·57. The extremes of the town mortalities are far apart owing to the excessive mortalities in certain towns due to a neglect of vaccination, which calls for reform. Rajanpur had a ratio over 9 per 1,000; Nowashar one over 8; and five towns ratios over 5; while the lowest mortality, excluding 47 towns wherein there were no small-pox deaths, was at Rawalpindi, one of the larger of the 151 towns. Of the 16,077 persons who died from small-pox, 5,001, or over 31 per cent., were children under one year of age; and 8,549, or over 53 per cent., children between the ages of one and twelve.

Central Provinces.—The number of deaths from small-pox in the Central Provinces fell from 7,747 in 1896 to 3,641 in 1897, and the ratio per 1,000 of population from 0·82 to 0·38. The quinquennial mean was 0·93. The province was not altogether free from small-pox in any month of the year; but the disease prevailed, as usual, with greatest intensity in the hot months, and declined in the monsoon season. Only three districts, namely, those of the Mahanadi Division, had ratios over 0·5 per 1,000; and the ratios of the other 17 districts lay between 0·05 and 0·5. In the division just referred to the district ratios were all above the quinquennial mean. The rural mortality was 0·38,

and the urban 0·43. The distance between the urban extremes was very great, the highest ratios being 18·08 at Drug, 9·04 at Mungeli, 6·73 at Ratanpur, and 4·14 at Bilaspur, the three last in the district of Bilaspur, and the lowest ratio 0·02 at Kamptee, while 38 towns had no small-pox mortality. In the 3,641 persons that died from small-pox were included 888 children under one year of age, or over 24 per cent., and 1,428 children between the ages of one and twelve, or over 39 per cent.

Berar.—The total number of deaths registered from small-pox was 617 against 810 in the previous year; while the death-rate was 0·22 against 0·28 in 1896, and against 0·20, the quinquennial mean. Out of the six districts of the province one had a ratio of 0·50, one a ratio of less than 0·05, while the ratios of the other four lay between 0·05 and 0·50. The rural mortality was 0·20, and the urban 0·50. While in 25 towns, mostly in the Ellichpur and Amraoti districts, there was no small-pox mortality, Balapur had the maximum, 6·20, and Akola the minimum 0·20. In Balapur, says the Sanitary Commissioner, the Superintendent of Vaccination personally did his utmost to assist the vaccinator in checking the spread of small-pox in the town, and in affording protection to the population, but difficulty was experienced with the Muhammadan inhabitants. The high ratios of seven towns the Sanitary Commissioner considers to be highly discreditable to the responsible town officials, who seemed to have failed in their duty of collecting children for the vaccinators. Out of the 617 persons who died from small-pox 191, or nearly 31 per cent., were under one year of age, and 241, or over 39 per cent., between one and twelve.

Madras.—The number of deaths from small-pox in Madras in 1897 was 21,678 against 9,410 in the previous year; and the death-rate was 0·67 per thousand of the population against 0·29 in 1896, and against 0·6, the quinquennial mean. The highest district ratio was that of Ganjam (11·7); five districts had ratios not under 0·5, fourteen ratios not under 0·05; and two ratios under 0·05. With regard to Ganjam the Sanitary Commissioner quotes as follows from the District Medical and Sanitary Officer :—

> "It must also be noticed that the customs of the Uriyas tend greatly to spread an outbreak of small-pox. The infected rags and mats, &c., are collected and thrown into the open, and the soiled clothing, &c., washed in tanks used for drinking purposes, thus disseminating the disease. Several instances have been brought to notice where the bodies of people dying of small-pox have not been buried, but deposited on tank-bunds or dry beds of tanks and other convenient spots. This matter was brought to the Collector's notice, and orders were issued to prevent this procedure. I fear it will not be possible to entirely stop this custom, nor will small-pox be kept in check until vaccination is made compulsory throughout the district."

The rural death-rate was 0·7, the urban 0·2; while the urban extremes were 5·8 at Palkonda and 0·02 at Coconada. Kampti (4·2) was the only other town with a very high ratio. Children under one year of age furnished 4,573 deaths, or over 21 per cent. of all the persons who died from small-pox; and children between the ages of one and twelve, 10,120, or nearly 47 per cent.

Coorg.—In Coorg the total number of deaths from small-pox registered was 59, against 18 in the preceding year; and the ratio of deaths per 1,000 of population was 0·34 against 0·10 in 1896, and against 1·37, the mean of the quinquennium. Deaths were registered in 26 villages out of the 517 in the province. Of the *taluks* Mercara had the highest ratio (0·82), the lowest being 0·03. The rural death-rate was 0·35, the urban 0·26, Virajendrapet being the only town with any small-pox mortality. No children under one year of age died of small-pox, but twelve, that is over 20 per cent. of all the persons that died of it, succumbed between the ages of one and twelve.

Bombay.—In the Bombay administration there were in 1897 deaths to the number of 3,835, against 6,443 in the preceding year, and the ratio was 0·20 against the 0·34 of 1896, and the 0·19 of the quinquennium. The disease reached its maximum intensity in March, a month earlier than usual, then declined, but rose again in the end of the year. Of the registration district ratios those of the Western and Sind districts were the highest. Two collectorate districts had ratios over 1 per 1,000, one a ratio over 0·5, twelve ratios not under 0·05, and nine ratios less than 0·05. The ratio for rural areas was 0·20. The mean urban mortality being 0·26, the extremes were 10·28 at Umarkot and 0·01 at Ahmedabad. The total 3,835 deaths from small-pox include 1,130 of children under one year of age, or over 29 per cent., and 1,779 of children between the ages of one and twelve, or over 46 per cent.

Lower Burma.—There were 1,950 deaths from small-pox during the year, and the death-rate was 0·43, as compared with 0·37 in 1896, and with 0·42, the mean of the previous five years. The disease persisted throughout the year, but was most fatal in April, May and June, and least so in October and November. There seems to be a general concensus of opinion among district medical and health officers that in the majority of cases inoculation is responsible for outbreaks of small-pox in Lower Burma. In one instance a public vaccinator had to be dismissed for patronising inoculation by private inoculators. The influx of unprotected coolies also spreads the disease. Only one of the three districts of the Arakan Division had a death, and the Tavoy district had no small-pox mortality. Two districts, Pegu and Toungoo, had ratios not less than 1 per 1,000 ; four, ratios not less than 0·5 ; seven, ratios not less than 0·05, one a ratio less than 0·05, and four no mortality. The rural death-rate was 0·45, and the urban 0·31, the extreme town mortalities being 0·91 at Henzada and 0·03 at Prome. Out of the 1,950 persons who died from small-pox 375, or over 19 per cent., were under one year of age ; 890, or nearly 46 per cent., between the ages of one and twelve.

Plague.

Plague is an acute infectious fever, in the causation of which the microbic factor is the *bacillus pestis* of Kitasato and Yersin ; the other factors being a susceptible animal and a suitable environment. It is the only known disease of the class which attacks epidemically and simultaneously man and certain of the lower animals.

Forms of Plague.—Although cases with severe intestinal symptoms have occurred, the experience of the present epidemic in India has so far not furnished any anatomical evidence that the bacillus has actually entered the body of a patient by the alimentary canal below the naso-pharynx ; while the demonstration of its entry by the skin and by the lungs is almost complete. If the bacillus in the penetration of the skin has entered directly into a blood-vessel, or if it is of so virulent a type, or attacks so susceptible a man, that it is able quickly to paralyse and overcome the leucocytes of the lymphatic glands, and pass on into the general circulation, the result is the rapid and fatal Primary Plague Scepticæmia. If, on the contrary, the bacillus, from its position in the tissues, and from its deficient virulence or the refractoriness of the patient towards it, fails to be dealt with by the lymphatic system, the disease assumes the bubonic form, the form which gives the patient the best chance, such as it is, of recovery. For recovery to take place, however, it is necessary that the disease should remain confined to the lymphatic system ; for, if the bacillus should succeed in passing the lymphatic filter-barriers and entering the blood-stream, the patient will almost certainly die of Secondary Plague Septicæmia. The situation of the bubo depends probably on the place of entrance of the virus, but is most frequently the groin, and the next most frequently the axilla. It would have been natural to suppose that plague pneumonia is always a secondary manifestation of plague septicæmia ; but the evidence of those who have studied cases clinically and anatomically in the present epidemic is clearly in favour of the occurrence of primary plague pneumonia. The main forms of plague, then, are :—

1. *a.* Primary Lymph Plague. *b.* Secondary Blood Plague.
2. *a.* Primary Blood Plague. *b.* Secondary Lung Plague.
3. *a.* Primary Lung Plague. *b.* Secondary Blood Plague.

Such are the divisions to which the reports of most observers more or less clearly point, and there is a very general consensus of opinion that the presence of the bacillus in the blood is an almost certain sign of a near approaching fatal issue. The first part of the report of the Austrian Plague Commission, however, speaks of bacilli being found in the blood of patients recovering from the disease, recognises only two forms, gland plague and lung plague, and asserts that the sick man does not die because he has bacilli in his blood, nor recover because he has not, but recovers or dies according to the amount of strength he has to fight against the disease. Further explanation will probably be given in the bacteriological part of the report, which has not yet been published. Simond's idea is that plague is always contracted by skin puncture, and that the difference between bubonic and septicæmic cases is simply due to different degrees of virulence of the microbe, a very virulent microbe attaining at once the lungs or the blood, a moderately virulent one being delayed by the group of lymphatic glands nearest the point of entry.

Clinically other divisions have been made, either as showing the position of the primary lesion, as in the Tonsillar Type, or as indicating the prevalent symptoms, as in the Gastro-intestinal Type.

Pathological Anatomy and Bacillary Distribution.—In primary septicæmic cases there is during life widespread tenderness of the lymphatic glands of the body ; and after death there is found a general involvement of nearly all the lymphatic glands, one member or group of which may show greater enlargement than the others, with a colour dark red or pink according to stage. There are hæmorrhages in the internal organs, the skin, the subcutaneous tissue, the muscles, and the mucous membranes ; parenchymatous degeneration of glandular organs ; swelling of the spleen, lymphatic glands, and bone marrow ; serous or sero-purulent inflammation of the convexity or base of the brain ; often miliary plague nodules in the lungs, liver, spleen, and kidneys, or larger solitary nodules. These nodules consist of masses of bacilli, and the bacilli are also found in the lymphatic glands and their surrounding tissue, in the blood, spleen, marrow of the bones, bile, urine, peritoneal fluid, juice of the base of the lungs, and fluid from the brain. In a case with hæmorrhages into the mucous membrane of the intestine the epithelium was found to be intact, and the bacilli were present only in the vessels and the extravasated blood, not in the mucous membrane or its follicles. In one case the *diplococcus lanceolatus* was found in a patch in the lung without the plague bacillus. In searching for the plague bacillus the examination must be made as soon as possible after death, as the bacillus disappears somewhat rapidly in the decomposing body.

The bubo is usually in the groin of either side, less commonly in the axilla, rarely in the neck, and most rarely in the supratrochlear or popliteal region. The limb corresponding to the bubo is swollen and œdematous, and petechiæ are usually seen upon it, but they are always in greatest number over the site of the bubo itself, and there may be a few over the body generally. The bubo consists of a chain of swollen glands matted together with serous and hæmorrhagic infiltration, and showing changes varying from medullary swelling to blood infarction, and from softening to suppuration and necrosis. The superficial bubo is often found to be continued into an internal bubo, or into a series of internal buboes, the most internal appearing to be the most recent. Death in the bubonic form of plague is so commonly due to secondary septicæmia that it is difficult to say what would be the appearance in a case of death from the pure bubonic form. Swellings, engorgements, hæmorrhages, cloudy swellings are described. In some cases Peyer's patches and the solitary follicles looked distinct, prominent, and slightly swollen ; but these were probably septicæmic cases. In the lungs there was engorgement with œdema, and, rather frequently small hæmorrhages into the lung tissue. The specific bacilli are found in enormous numbers in the glands of the bubo and in the surrounding hæmorrhage, in the latter probably only after the bacillus has gained access to the blood.

The Bombay Plague Research Committee says that there was no autopsy which went to show that the plague bacillus had reached the stomach or intestines, *e.g.*, in food, and had thence infected the mesenteric glands; and the German, Russian, and Austrian Plague Commissions give similar evidence.

In the primary pneumonic form the only marked evidences of disease are found in the lungs, whereas the lymphatic glands and other organs are scarcely at all affected. No petechiæ were observed in the skin, and large internal hæmorrhages were absent ; but petechiæ on the surface of the heart, in the pelvis of the kidney, in the bladder, stomach, and intestines, were commonly present, probably as the result of the toxin circulating in the blood. Throughout the lungs, but especially in the lower lobes, are patches of lobular pneumonia, and sometimes a mixture of hepatisation and catarrh produced a lobar form. Occasionally necrosis and hæmorrhagic infarction were observed, and of course tubercle was sometimes simultaneously present. Sometimes there are bronchial buboes, sometimes not. Plague bacilli are found in abundance in the pneumonic patches, and sometimes in alveoli which show little or no signs of inflammatory reaction. In one case the *diplococcus lanceolatus* was found by the German Commission along with the plague bacillus ; and Sticker states that it may be associated with that, or the streptococcus, or the influenza bacillus.

Histology.—Childe of Bombay, the describer of primary plague pneumonia, treats of the histology of this and the other forms in the report of the Bombay Plague Research Committee. Some German papers on the subject concern themselves with the lesions produced in animals by artificial introduction of the virus.

The Plague Bacillus.—The bacillus is usually stated to have been discovered by Kitasato and, almost simultaneously, by Yersin at Hongkong in 1894; but it seems that the descriptions given of the bacillus by Kitasato and by Yersin were somewhat different, and that that of Yersin corresponds the more closely with what has been found by subsequent observers. Kitasato described the microbe as motile and stainable by Gram's method, Yersin as non-motile and not stainable by Gram's method. Most subsequent observers have agreed with Yersin that it is non-motile, but on the other hand, its motility and the presence of flagella have been affirmed. The bacillus varies much in different circumstances as to the relation of its length to its breadth; but the typical form is that of a short spindle, such as may be obtained from a plague patient or from a cultivation on agar at 37° C. Because its breadth is great in proportion to its length and its ends rounded, it approaches more or less to the form of a coccus, and has therefore been described as a cocco-bacillus; and on agar at 37° C. such cocco-bacilli form chains like those of the streptococcus. In fluid media the chains are still longer, and the individual bacilli also tend to be longer. A peculiarity of these chains is that after every few links there is a kink from two adjacent links being set askew to one another, and long chains show sudden sharp angles or knicks. The bacillus is easily stained by all the ordinary basic aniline dyes, but not by Gram's method. The stain appears chiefly in the poles, leaving the centre of the bacillus unstained, or nearly so. Observers have given differing opinions as to its possession of a capsule when in the tissues or fluids of its host. No spores have been discovered.* The plague bacillus is agglutinated by the serum of a plague patient after the method of Widal.

Cultivation of Bacillus.—The bacillus can be cultivated on all the ordinary laboratory media, but prefers the addition of glycerine. A very favourable medium is said to be an alkaline 2 per cent. peptone solution to which 1–2 per cent. of gelatine has been added. The growth of the microbe in broth is said to be characteristic, in that it resembles much that of the streptococcus, flocculi being deposited. Alkaline broth containing fat, according to Thomson, produces flake-like islands underneath the surface, which fall to the bottom like vermicelli choppings, on shaking the containing flask. This growth appears in 24 to 48 hours, and continues to grow and develop fresh festooned flakes for upwards of a month. On agar at 37° C. pin-head-sized colonies appear in from 24 to 48 hours. The colonies on agar are whitish and transparent, and by reflected light their borders are iridescent. Abel states that the bacillus can grow in acid media, and that it can be cultivated anaërobically; but the former statement is opposed to the large experience of Hankin, and the latter does not appear to be corroborated by other observers. Conflicting statements have been made as to the capacity of the bacillus for surviving and growing in milk, but probably these differences are due to differences of reaction, as Hankin has shown that whenever milk begins to assume an acid reaction, it begins to obtain the power of destroying the *bacillus pestis*. Klein has pointed out a curious diagnostic dimorphism of the colonies grown on the surface of gelatine. Yersin also originally described dimorphism in agar colonies, and maintained that the two different kinds of colony in the same culture possessed different degrees of virulence, and that the milder varieties tended to overgrow and choke the more virulent. Abel corroborates the fact of the dimorphism, but did not succeed in finding the different degrees of virulence. Kasanski also observed dimorphism. Under unfavourable circumstances, such as old dried media, the bacillus forms bloated involution-forms which are useful for diagnostic purposes. Hankin and Leumann discovered that a rapid way of obtaining such forms was to transfer an agar culture to salt-agar. Such forms also occur in the human body, but Hankin found that this was altogether a *post-mortem* phenomenon.

Degree of hardiness of the Bacillus.—The optimum temperature for the bacillus is 37° C., but its growth is also good at temperatures so low as between 22° and 24° C. Below this its growth is retarded; but it has withstood exposure to cold of —20° C., and has survived repeated freezings and thawings. Temperatures above the optimum retard the growth of the bacillus more than those below it; and moist heat at 80° C. kills the microbe in 10 minutes, at 100° C., in one minute. The usual statement that the *bacillus pestis* cannot survive drying requires some qualification. The fatality of drying to the bacillus is directly proportional to the rapidity with which it is conducted and to the temperature at which it is conducted. Thus, rapid drying at 37° C. (the very temperature at which the bacillus flourishes best) is more quickly fatal than slow drying at a lower temperature, and rapid drying at 37° C. is more rapidly fatal than slow drying at the same temperature.

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* But *see* Schultz in C. B. XXIII., page 597.

Diffused sunlight appears to have no effect, and the number of hours required by the direct rays of the sun to destroy the bacillus depends on the thickness of the layer in which the bacillus lies and the facility with which the rays can get at it. Even when placed in the most favourable circumstances, *i.e.*, when kept moist and sheltered from light and heat, the life of the bacillus placed in *thin* layers on various articles of clothing of common use is generally measured only by days. Experiments have, however, been published, by Gladin among others, which seem to show that on certain materials and under favourable conditions as regards nutriment, moisture, temperature, and shelter, the bacillus may survive for weeks or even months. Some of the most recent experiments, such as those of the German Plague Commission and of Mr. Hankin, are those which give the shortest survival-periods. It is true that Gabritschewsky says that when kept moist and sheltered, in water, agar, pus, or blood, the bacillus can live for months and years; but in the absence of full details of his paper it is not known whether this is merely an inference or is the result of actual observation. Recent experience in Bombay is that the bacillus is delicate and short-lived under all experimental conditions. There is some contradiction between this and the persistence with which the infection has been known to cling to some places; but the explanation may be that for persistence the bacillus requires the help and services of a living host, the possible hosts occupying various heights in the scale of the animal kingdom. Details of the various experiments will be found in the works to which reference is given. It may be said, however, that so long as the microbe remains in life, it retains its virulence, though its action may be delayed; and that its survival depends on supply of nutriment in suitable surroundings.

To ascertain what danger there is from the buried bodies of those dead of plague, Yokote made some experiments by burying the bodies of plague-mice in little coffins. He found that the bacilli died out in from 22 to 30 days, the rapidity of their disappearance being proportional to the amount of heat and putrefaction present, and that the bacilli did not come out into the earth round about the coffin.

Gladin examined a large number of microbes in conditions of rivalry with the *bacillus pestis*, and found that, except in the case of one (*sarcina aurantiaca*), the latter invariably got the worst of it. Among them was the staphylococcus.

Large numbers of experiments on the action of disinfectants on the bacillus have been made by various observers, and particulars of these may be found in the works to which reference is given. Suffice it here to say that the experience of the laboratory was not always found directly applicable to the bacillus in its natural habitats, and that different antiseptics were found best for different circumstances. Those which have been found of most universal application are fire, boiling water, and an acidulated solution of corrosive sublimate. The last is made by adding two parts of a 1 : 250 dilution of sulphuric acid to 1,000 parts of a 1 : 1,000 solution of corrosive sublimate.

The virulence of the bacillus has been observed to vary, and this is one of the factors supposed to determine whether a man shall suffer from the bubonic or the septicæmic form of plague. Yersin and Metschnikoff state that passage through a guinea-pig increases the virulence of the bacillus, and Devell found the same for frogs. Hankin, however, states that, though the same rule applies to mice, passage through rats is, contrary to expectation, attended by diminution of virulence.

The plague bacillus in nature.—It cannot be said that the bacillus has ever been found in nature uncontaminated by man, or that it is often found in the earth, air, or water of plague surroundings. It has as yet never been found in air, but perhaps no experiments have been made with the air surrounding a patient sick of primary plague pneumonia. The plague-like bacilli found in earth by Yersin were not pathogenic, so that their identity is doubtful. Haydon and Gibson have tried in vain for months to find the bacillus in soil and in the floor scrapings of infected houses, and Hankin appears to have met with as little success. Leumann was successful in 3 out of 25 cases, but thinks the floors had been recently contaminated, probably by sputum. Ogata did not succeed in inoculating animals by means of earth from infected localities; but Kitasato obtained a positive result in one mouse with house-dust, the other mice inoculated dying from tetanus. Haydon and Gibson also failed in earth-inoculations, the animals dying of malignant œdema. Wilm reported that he had found the bacillus in one out of three wells near Kowloon (China, opposite Hongkong) at a time when plague was prevalent; and the following is the only instance in which it was detected by Hankin:—

"Sewree Koliwada is a village in the north-east of the island of Bombay, containing a population
" of some 600 Kolis, inhabiting about 150 houses.

" The first case of plague reported in the village occurred on the 12th of December, but it was not " until January that the disease became epidemic. The disease here, as in Worli, was marked with " great virulence, nearly every case being fatal.

" Disinfecting operations were carried on all through December and January in individual affected " houses, but had little or no effect on the spread of the disease. On the 27th January these opera- " tions were extended, and some 200 coolies were placed on the work; they disinfected and " limewashed all and every house; rags and *kutchra* were burned; all roofs were opened for " ventilation; and the place generally had a thorough cleansing. This work lasted five days, and the " spread of the disease was checked. But at the back of the village there was in December and " January a long and narrow pool of water. This pool was daily largely used by the male population " of the village for ablutionary purposes in connection with defæcation. Mr. Hankin in his researches " at this village about the 24th January discovered the plague bacilli in large numbers in this water. " Upon this being known, the pool was thoroughly disinfected with carbolic acid on or about the " 27th January, and the whole field, which was littered with human excrement, was cleaned up. " It is possible that in this incident lies the crux of the situation. Disinfecting operations apparently " up to January 27th had very little effect on the spread of the disease, and it may be conjectured " that its spread was fostered and maintained by the daily use of the water in the pool, especially " when we know that most of those affected were males. The incident, however, is of interest, as " from the 27th January little or no disease occurred in this village, which, although considerably " reduced in numbers, was not altogether depopulated, there being never less than 350 people in the " place. The disease did not form itself into groups, as is usually the case, but was almost evenly " distributed over the village, there being rarely more than one case in a house. This points to an " unusual element in the spread of the disease, and this element General Gatacre believes to have " been the use of the water of the polluted tanks."

If the means of investigation at present available are adequate, these results, so far as they go, indicate that soil, air, and water do not become generally infected during an epidemic, but are only subject to temporary local contaminations.

Dissemination of bacilli from the sick.—In order to understand how far a plague patient is likely to contaminate his surroundings, it is necessary to remember what has been said under the head of " Forms of Plague." A man suffering from pure bubonic plague has no means of disseminating the bacillus, except, it may be, from a skin wound; but, unfortunately, the majority of cases progress towards a fatal termination by becoming septicæmic, the bacillus breaking through the lymphatic barriers into the blood stream. In that case the hæmorrhages, which have been shown to be so common in plague, will contain bacilli, and in this way the latter may come to be excreted by the alimentary canal, by the urinary organs, or by the air passages. It has even been reported that the bacillus has been found in the milk of lying-in women suffering from septicæmic plague. It is much more often found in the urine than the fæces. It has been said by Germano that, as the *bacillus pestis* cannot survive drying more than a day, it is not likely to be conveyed by the air in a virulent condition; but the researches of Flügge on *bacillus prodigiosus* have shown that a microbe can be readily disseminated in a room in the fine spray which results from coughing. In this way plague pneumonia cases may well be supposed to spread infection, and with this supposition the opinions of clincial observers agree. It is precisely in this form of plague that the chief danger to nurses and medical attendants appears to arise.* The fact noticed above that in pure bubonic plague there is no shedding of the virus by the sick probably explains those cases where a woman sick of plague has borne or suckled an infant without communicating the disease to it, and where a suckling with plague has not communicated it to the mother. Thomson quotes Dieudonné of the German Commission as stating that in Bombay in only one case of plague that recovered was the bacillus demonstrated in the blood, and that was in a child 4 years old, with right parotid bubo, in whose blood bacilli were found four times in five examinations. The statements of Kitasato and of Wilm as to the finding of bacilli in the bodies, blood, and excretions of patients days or even weeks after the cessation of active symptoms must be received with reserve. When a bubo has spontaneously softened and burst, its contents are often, if not always, found to be sterile, not to contain any plague bacilli; and in cases where the staphylococcus has gained access to the bubo, it soon overgrows and destroys the plague bacillus. It has always been held that plague can be spread by means of clothes; and from what has already been said it may be gathered that patients' clothes have opportunities of becoming infected, and that under favouring circumstances the bacillus may thereon maintain vitality and virulence for considerable periods. Wilm claims to have cultivated the bacillus from soiled clothing and bedding. Two cases are quoted by Hankin in which it appears that the virus was preserved in clothing for respectively about 36 and about 10 days. The second of these cases will be quoted again

* One attendant who had been in the habit of finishing off the remains of patients' stimulants was ultimately attacked with rapidly fatal plague.

below as showing that the infection carried by clothing is not always directly conveyed to man, but sometimes indirectly.

Mild Cases.—It has already been mentioned that the virulence of the plague bacillus is subject to variation ; and man is less susceptible than the rat. There are also grounds for supposing that among susceptible kinds of animals there exist individual differences of susceptibility. According as a more or less virulent bacillus attacks a more or less susceptible man, there results plague of all grades of severity, from the acute and rapid primary septicæmic cases to such mild cases as have been described by General Gatacre, and by the German Plague Commission. These mild cases were seen as men or boys with one day's fever and slight tenderness of one gland ; or even without fever, but with stuffiness and headache, or pains in the limbs, or slight digestive disturbances, and recovering in a few days ; and the diagnosis was confirmed by the fact of the patients belonging to families suffering from plague, by the undue weakness remaining, and especially by the irritability of the heart left behind. Lyons, on the contrary, reports that no such cases were seen by the Plague Research Committee. Some cases supposed to be plague were found by the German Plague Commission on bacteriological examination to be caused by other microbes, such as the influenza bacillus.

Other factors in causation.—It has been stated that not only are drought and famine* frequent precursors of plague, but that all great epidemics of plague have been preceded by epidemics of influenza. Whether that general assertion be true or not, it is a fact that, besides the drought and famine of 1896–97, influenza has been prevalent in India since 1890. With regard to climate and temperature all that can be said with certainty is that in the hottest and driest part of the year there has been a lull in the plague epidemic ; but how far this is due to the fact that men are more out of doors, and sleep more out of doors in that season of the year than in the cold weather and rains, and how far the recrudescence in the colder seasons is due to the bringing out again of infected clothes, is not known. That plague can exist in the Himalayas of Garhwal and also at the sea-level in the Bombay Presidency is evidence that elevation above the sea-level is of itself of no account in the etiology of epidemic plague. But it seems to have something to say to plague endemicity ; this being probably due to the fact that on account of the cold causing disinclination from ablution the inhabitants of elevated regions are more dirty in their persons, and, in order to economise warmth, more crowded, shut up, and insanitary in their dwellings. Density of population, poverty, dirt, overcrowding, deficient ventilation, may invite plague into a town ; but once the plague has started, it does not confine itself to the worst parts of the town. It has been said that "plague does not go upstairs," and the Health Officer of Bombay shows that fewer deaths from plague occurred in upper stories than in lower ; but statistical objection has been brought by Hankin against this method of stating the case. Certain statements have already been made with regard to the relation between plague and geological formation ; but the subject will be better discussed when more is known about it, when the epidemic has revealed its final boundaries. Men have been attacked more than women, and young adults more than other men. In Bombay there has appeared to be some ground for believing that meat-eaters were less liable than vegetarians, perhaps because, as the Austrian Commission thinks, the latter are usually inferior in stamina. The comparative exemption of Europeans and rich natives has probably been due in great part to their better built houses and to their more fastidious personal habits. It was sometimes noticed that banias were the first to be attacked, or people living above or close to grain-stores ; and this has been connected with the facts that grain attacts rats, and that rats are very susceptible to plague infection. The sight of plague-intoxicated rats in the street in open daylight was often the harbinger of an outbreak among men. The condition of a house in regard to the accessibility of its living rooms for rats is believed by the Health Officer of Bombay, by Mr. Hankin, and by others, to be the most important of all the environment-factors. The dwellings of the poor are badly built, in bad repair, contain articles of food tempting to rats, and are accordingly swarming with rats ; while the houses of the rich are well-built, are kept in good repair, so do not offer thoroughfare for rats, and articles of food are not kept in the sleeping or sitting rooms, but often altogether separately in out-houses.

Animals and natural infection.—The animals which in India have been found liable to natural or spontaneous infection by plague are rats (very frequently), mice, squirrels,

* Refractory animals, such as pigeons when starved, were found by de Giaxa and Gosio to become susceptible.

grey and brown monkeys. Some cases in which cats were suspected of being so infected are mentioned by the Health Officer of Bombay, by Mr. Hankin, and by the medical officers of three affected native regiments ; but bacteriological evidence has not been adduced. In the report of the Bombay Plague Research Committee it is stated that there was post-mortem evidence of one dog having been affected, but there is no mention of bacteriological confirmation. Dogs are also mentioned by two medical officers of native regiments, and squirrels by one. In India the animals noticed to be immune from natural infection are pigs, sheep, goats, horses, cows, birds.*

Rats.—That rats die numerously in times of plague has long been known ; but, since the discovery of the plague bacillus, bacteriological investigation has shown that at such times it is from plague actually that they die. This has been repeatedly verified in India, the bacillus being found in the bodies of rats found dead in streets or houses. By placing healthy and infected animals in contiguity, Yersin proved for mice, and Simond for rats, that the disease is communicable from animal to animal. In the present Indian epidemic, though local outbreaks have occurred in which there was no observed mortality from rats, as in Hardwar, Bellary (1898), and some of the Kathiawar and Punjab villages and towns, yet in most of the reports the mortality of rats and their connection with the spread of the disease are emphatically noticed. Grain depôts were often the first centres in the spread of the plague. The infection having been imported into the colonies of rats that haunt the depôts, spread among them, and they died in large numbers. The grain dealers in this way were sometimes the first human beings to be affected. Rats when sick of plague come out of their holes into the light of day, tumbling about in a dazed condition, so that they have been described as appearing to be drunk or mad, and it appears that their object is to seek water to appease their thirst. When a certain number of rats have died, the remainder are apt to forsake the place ; and it is evident that this migration must aid powerfully in the dissemination of the disease. It is quite possible also that the liberal use of disinfectants, by making the place intolerable to its rats, may have been instrumental in driving rats with infected individuals among them further afield. To avoid this as much as possible, Hankin has recommended the use of corrosive sublimate for infected places, and of odoriferous disinfectants for localities as yet uninfected. It has been said that concealed cases may continue among rats after the human outbreak has ceased, and Simond claims to have actually found such cases. On the other hand, the disease may continue among men after the rats have left the place or have ceased to be found suffering from plague. It is important to note also that after a village has been evacuated by its human inhabitants, the disease may still go on spreading among the rats, with the result that the village may become more widely infected, and therefore more dangerous to occupiers than before. It is supposed that the interval between two outbreaks in an epidemic at a place is the time necessary for the renewal of the rat-population. Mice do not seem to suffer to anything like the same extent as rats. That rats are an important factor in the spread of the disease in a large city is shown by Mr. Snow, the Municipal Commissioner of Bombay :—

" It would be futile to report on or discuss an epidemic of bubonic plague without considering " the part played in its spread, and the propagation of infection by the hundreds of thousands of " rats which infest a city like Bombay. Their presence probably nullifies to an enormous extent " the advantages to be derived from ordinary human remedies, while their absence, if such a " state of things were ever found in cities and towns, would undoubtedly render plague operations " far more effective.

" From the time the bubonic plague had established itself in Mandvi at the end of September 1896, " large numbers of rats were seen running about the streets and coming out of house connection " pipes and drains in a sickly or dying condition. Many of them had buboes actually developed " on the neck and groin. Bacteriological examination was carried out by the various specialists " present in Bombay on numerous specimens, and the plague bacillus was freely detected. It was " thus clearly proved in Bombay from the outset, as has invariably been the case in other places, that " the disease attacks human beings and rodents. Those acquainted with the life-history and " characteristics of the rat tribe are aware, if I may use the expression, of their extremely clannish " habits. They appear to have regular means of communicating to each other any causes or " symptoms of alarm, disease, and danger. As an instance of this I may mention that when the " well-known preparation 'rough on rats' has been used with success in an infested house for " a few days, the rats altogether disappear and will not be found to return for several months, " sometimes longer.

" In almost every quarter of the city where the bubonic plague appeared in force it was preceded " by the presence of dying rats in considerable numbers. This condition was noticed both in the

* de Giaxa and Gosio found starved pigeons become susceptible.

" houses, open streets, and gardens. In addition to this, a regular migration of rats speedily manifested
" itself; its course was, generally speaking, from east to west and thence up the sides and centre of
" the island due north. Minor migrations also took place in the south of the city, and that on
" Malabar Hill was especially noticeable.

" The bubonic plague travelled principally from east to west and then north, throwing out branches
" to the south, and obtaining a footing on Malabar Hill later on. By the commencement of December
" nearly all the rats had disappeared from Mandvi and adjacent quarters of the city, while they were
" noticed in Kamathipura, Tardeo, and Byculla in great numbers, many of them being found dead.
" The bubonic plague followed in their track with unerring regularity. I was so struck with this
" portion of the plague phenomena that, in the end of December and January, I made a series of
" verbal inquiries from natives in various parts of the town. The replies were invariably the same,
" that the rats had disappeared from the centre of the city, and were observed in great numbers on
" the west and north. In my opinion it is useless to seek further for the origin of the severe
" outbreaks in Worli village, Mahim, and Bandra on the west, and Parel, Naigaon, Sion, and Dharavi
" on the northern side. The enquiries I made showed that vast numbers of rats flying from the
" danger of the pestilence moved steadily in those directions and were noticed in numbers in places
" where they had not before caused remarks. In this way not only would the local stock of rats have
" become infected, but the pestilence would be carried far and wide through the various houses.
" The great majority of the rats seem finally to have left the island, for in most of the infected
" localities only a few have been noticed up to the end of July where swarms existed before. The
" probability is that thousands of them crossed into Salsette and were in great measure the cause of
" the outbreak in so many Salsette villages of the Thana District.

" The migration of the rats on Malabar Hill was of later occurrence, as the plague did not get a
" firm hold there till the commencement of 1897. Many rodents were observed dead or dying in the
" houses along the Walkeshwar, Pedder, and Nepean Sea Roads, and subsequently on the ridge of the
" hill, just before disease broke out in force. By the middle of March not a rat was to be seen or
" heard on Malabar Hill, and yet in ordinary times they infest the whole locality and are constantly
" appearing or making their presence known. They have never returned, or only such a few as to be
" unnoticeable. Since last March, on the ridge where they were very plentiful, I have never seen a
" rat, and only a few of the musk tribe remain.

" Precisely the same phenomena as regards rats have been noticed in Karachi during the recent
" epidemic. Dead rats were found in the vicinity of many infected houses as far back as December,
" and in one of the principal streets running through the main bazar dead rats were picked up in
" hundreds during the first week of February, at which period and subsequently plague was raging
" in the vicinity. The march of the rats in Karachi was from west to east, and the outbreak and
" course of the plague in the various districts corresponded with and followed their migration.

" The rats at Karachi finally proceeded in great numbers to the Civil Lines, where they were
" noticed in swarms such as had never before been seen there. The epidemic in these lines was of the
" slightest and practically confined to a few servants of European residents. The obvious conclusion
" is that the rats migrate on the first symptoms of danger, and dropping all their sick and diseased as
" they go along, keep ahead until they reach a place of comparative safety or have obtained freedom
" from the disease. The return of the rats has been noticed in several godowns in Karachi since
" June, and this, coupled with the fact that the plague has entirely disappeared, may be regarded as a
" sign that all danger is over, at all events for the present. It will thus be observed that, as far as it
" is possible to compare a small city like Karachi with Bombay, precisely the same phenomena have
" been observed in regard to the movements of rats and their connection with the propagation of
" bubonic plague.

" The conditions detailed above are of the gravest import, and must largely influence the spread of
" the plague and the efficacy of any measures to be devised against it. It is indeed difficult to see
" how any measures of disinfection or segregation could fully avail until the migration of rats had
" ceased and the infected localities were free of this moving pest. While it is clear that until some
" effective means of destroying the rats *en masse* or preventing their migration is discovered the
" restriction of the spread of plague at its outset in any large city or town becomes an impossibility.
" It is extremely unlikely that any effective measures will ever be devised for dealing with this
" contingency, and while the migration which in Bombay lasted in the various districts for several
" months was going on, any advantages to be obtained from segregation and other measures were
" reduced to a minimum."

In one infected house in Mokundpur in the Punjab as many as 200 dead rats were found; and the finding of them in or near infected houses was in the affected parts of India also very common. They were not always found in the houses in which cases of plague had occurred, but sometimes in the houses surrounding it. Cases of plague on board the steamers *Shannon* and *Patna* were, according to Simond, preceded by the finding of dead rats on board. It has been supposed that careless or incomplete burial is apt to lead to the spread of plague, by giving rats an opportunity of gnawing the dead body, and the following case, which occurred in the village of Khankhanan in the Punjab, shows that the danger may not be altogether imaginary. An old woman died of plague, and her body was locked up in the room for medical inspection. When the medical officer arrived next morning, it was found that the nose and part of one cheek had been gnawed away. The body was burned as soon as possible. In the next few days every house in the block of buildings in which the corpse was found was affected, and, when the houses were afterwards disinfected, a number of dead rats were found in them. If men suffered without rats in Hardwar, rats appear to have suffered without men at Mahim and perhaps Kankhal (at first); the rats of Old Kurla are supposed to have conveyed the

disease to the rats of New Kurla; in some cases the advent of a plague-sick man to a house was followed by plague among men; in some first by plague among rats and then by plague among men; cases have already been given where rats are supposed to have conveyed the plague to men; Hankin quotes the following case from Collie, showing the progression—clothes, rats, men. A man lost his wife at Bombay. Ten days after he took her clothes and jewellery to a house of his in a village near Hurnai in the Ratnagiri District. About a week after dead rats were found in the house and its vicinity. Six members of the family died, the last being the man who had come from Bombay. None of the others had left the village, which after this importation, was severely visited. Cases have already been given in which the order was man, clothes, man, without the intervention of rats. But the most curious cases are those in which the arrival from an infected locality of healthy men, who do not themselves subsequently develop plague, is followed by plague either among the inmates of the visited house, or first by plague among the rats and then among the inmates.

The Bombay Plague Research Committee says it is evident that infection may be carried by rats to persons who have never been brought into contact with plague patients nor with persons visiting plague patients, and whose food and clothing could not have been contaminated in any other way; and Simond (page 636) gives cases which seems to support this view. It seems likely, however, that rats play a greater part in the dissemination of plague within a village or town than in its conveyance from village to village or town to town, this latter being more frequently the work of men, either in person or by means of clothing. It has been stated by Clarkson that if the plague is brought by rats, men are attacked in a few days, but that if it is brought by men, neither men nor rats are attacked for a month or six weeks after; but some of the cases given by Logan and Anderson contradict this. Ogata stated that in Formosa handling dead plague-rats was regarded as dangerous, and he himself seems to have been alive to the possibility that the fleas on the animal might constitute the danger. Simond and Hankin quote a Bombay case in which 20 coolies were employed to gather and dispose of dead rats in a warehouse, and 12 fell ill of plague within 3 days. Simond mentions the case of a coachman who picked up a dead rat and threw it away on the 13th of the month, and was attacked on the 16th of the same month. Hankin gives another case in a man whose duty it was to clean a house in which the bandicoot rats had been attacked, and to remove the dead rats. An important point noticed by Simond is that when a man gets plague as a result of handling a dead rat, his bubo is at least just as often inguinal as axillary. This seems to lead up to the idea that though the rat is an important agent in the spread of plague, it is not absolutely necessary, and that there is a missing link between the rat and man. Simond says that so long as the rat's body harbours fleas it is dangerous, but that after the fleas have deserted it (probably in about 24 hours) it can be handled with impunity. Notwithstanding the opposite opinion of Bitter and Rogers, it would appear that in India rats have played a very important part in the dissemination of the disease; but Payne and Hankin both notice that rats may not have had much or anything to do with the spread of plague in England in the old days; and Hankin suggests that even in India the importance of its rôle may be different in towns and rural areas, or even in one part of India and another.

Animals and Artificial Infection.—Haffkine found that horses, goats, cows, and sheep were immune against artificial infection by inoculation. The German Plague Commission found pigeons,* fowls, geese, pigs, to be absolutely refractory, and dogs almost so. In the case of cats, sheep, goats, cows, horses, there was more or less general and local reaction, but no plague developed, and all the animals recovered. Of all the animals tested, says the German Plague Commission, the rat is by far the most susceptible. Simple inoculation with the smallest quantities of a culture invariably produces fatal plague in a few days. But so susceptible is the rat that it is not necessary to wound it at all: it can be infected from the unwounded, mucous membranes, and by way of the alimentary canal. Rats died whose conjunctiva or nasal mucous membrane had been merely touched with a small quantity of a pure cultivation. Others died after having been fed with very small quantities of bacillary culture, or after having gnawed the bodies of rats dead of plague. As this gnawing of the bodies of their own dead is a common habit of rats in a state of freedom, it is easy to see one reason why plague spreads so rapidly among them. Some rats into whose mouths pure cultivation was trickled died of plague. In one of the five cases the path of infection could not be traced; but in the others it was

* Found by de Giaxa and Gosio to become susceptible after starvation.

either aspiration into the lungs, or, as shown by the presence of local buboes, through the mucous membrane of the mouth. The grey monkey, says the German Plague Commission, is as susceptible as the rat to inoculation, natural or artificial, by minimal quantities of the virus through the skin ; while the brown monkey, being refractory to small quantities, can only be inoculated artificially. It has since been shown, however, that the brown monkey is susceptible to natural infection, though, possibly, not so readily as the grey. To give plague through the alimentary canal to brown monkeys, they must be fed with large quantities of plague culture. The animals die in a few days, and show severe hæmorrhagic infiltration of the stomach and intestines. Hankin considers that in order to infect a rat by feeding, the bacillus used must be a very virulent one ; and Yersin, Calmette and Borrel state that plague bacilli directly taken from man are effectual. Yersin found that he could infect mice sometimes, rats almost always, by feeding them with pure culture, or with pieces of plague-spleen or liver. Sticker says that intestinal plague can be demonstrated by feeding rats and monkeys, there being lesions of the mucous membranes and symptoms like those of intestinal anthrax or malignant enteric fever. Bandi and Balistreri found that in guinea-pigs plague by feeding was a more chronic process than plague of other introduction, and that it sometimes resulted in secondary plague pneumonia. Klein discovered that in guinea-pigs dead of plague produced by sub-cutaneous injection of a virulent culture, plague bacilli could be found on the free surface of the mucous membrane of the trachea and larynx, and in the slimy fluid contained in the inflamed duodenum. Wyssokowitz and Zabolotny in Bombay found that, while they could give primary plague-pneumonia to monkeys by injection of plague bacilli into the trachea, injection into the stomach did not produce plague, though any little wound of the buccal mucous membrane readily led to infection. Simond obtained negative results from feeding rats, mice, and monkeys ; also from inhalation in a monkey ; also from application to a little wound in a grey monkey. In a note to Simond's paper Roux says that it is quite easy to infect rats by placing on their nasal mucous membrane, without excoriating it, a few plague bacilli from an agar culture or from the spleen of a plague-animal ; and suggests that it would be interesting to know whether the nasal mucus of rats affected with plague is infectious. Wyssokowitz and Zabolotny, experimenting with monkeys, found that if the amount of virus inoculated by the skin was great there was œdema ; but a small wound made in the palm of the hand with a needle showed absolutely no reaction, and quickly became invisible, though a local bubo formed, and the animal died in from 3 to 7 days. No reaction at the wound was discoverable at the *post-mortem* examination. Similarly, a monkey inoculated by a pin-prick on the foot developed inguinal and retro-peritoneal buboes, and died in 10 days. Lyons corroborates this account. Mice and rabbits are also among the animals to which plague can be artificially communicated.

Insects.—Yersin in Hongkong, having noticed a number of dead flies in his plague laboratory, triturated them with water, and injected them into a guinea-pig, with the result that the animal died of plague. Nuttall afterwards found that flies fed with plague organs, though they ultimately died, could continue to go about several days with still virulent bacilli in them. In Formosa, Ogata counted 15 and 20 fleas, respectively, on two dead rats found on the road, but on a rat which had been dead for some hours he found none. He rubbed up seven of the fleas found on the dead rats with water, and injected them into mice. One mouse died, the other did not. Some guinea-pigs in his labratory about this time died of plague, and he suspected that the infection might have been conveyed by insects, if not by food. In the fleas taken from the dead rats he discovered virulent bacilli, and recognised that the bacilli might in this way be conveyed to man ; and he recommends that the sick of plague should, for the sake of others, be kept under mosquito-curtains. Hankin noticed that ants cut up dead rats, and carried the fragments off and about, and therein he recognised a danger ; but, as they did not die themselves, and did not retain the infection long, he considers the danger not great. They were found infected only where rats were dying, not where men only were dying. The German Plague Commission considers it doubtful whether insects can inoculate the disease, and certain that mosquitoes cannot, looking to the immunity of sick attendants, who are constantly being bitten. They found, however, that fleas taken from a rat found dead contained virulent bacilli, which, inoculated into a guinea-pig, produced plague. Sticker, one of their members, formed a decided opinion as to the rôle of insects above-ground, as contrasted with the rôle of rats underground, mentioning especially those which feed on living or dead rats—ants, pediculi, and perhaps mallophagi and acari. Except in the case of pneumonic plague, he considers insects the chief agents of infection-carriage from the sick. Simond found that the flea which infests rats attacks both men and dogs. A

healthy rat keeps itself free from fleas ; but when a rat falls sick, and loses the energy to keep itself clean, the fleas multiply upon it and overrun it. In several cases he found in the intestinal contents of such fleas bacilli morphologically identical with those of plague. The fact that he had no opportunity to cultivate them matters little in view of the success obtained by others, as noted above. He inoculated three mice with triturated fleas, and one of the mice died in 80 hours of plague. The others died in 9—12 days, but the bacillus could not be found in them. A rat suspected of plague was placed by Simond in a large wide-mouthed glass bottle. It was seen to have a few fleas upon it, and 20 more from a cat were thrown in upon it. At the end of 24 hours the animal seemed to be dying. There was then lowered into the bottle a little iron cage with only one side grated, containing a small rat. The first rat died soon after, but its body was left in the cage for 36 hours. It was found to have died of plague. The young rat remained in the cage and bottle. It died on the fifth day of characteristic plague. Three more similar experiments were afterwards made, one successful in the case of a mouse, and two unsuccessful in the case of two adult rats. Simond attributes the two successful results to the agency of the fleas, not only because the animals were separated by a grating, but also because he never succeeded in infecting a rat or a mouse by placing it in contact with an animal inoculated in the laboratory and free from fleas. In one case the body of a rat dead of spontaneous plague at Karachi, and freed from fleas, was left for 24 hours in a cage containing 7 healthy rats, none of which contracted plague. One would have almost expected to be told that the seven rats had devoured their dead companion, and perhaps that some of them had contracted the disease in that way. Simond cannot explain exactly how the flea infects. It is not likely that the flea's lancets can retain the infection long ; but it may be readily observed that the flea, during suction, deposits where it sits a drop of liquid dejection, and in cases where this drop is a cultivation of the plague bacillus, it may inoculate the wound made by the flea's lancets. Further researches are required as to the persistence and ultimate fate of plague bacilli in the bodies of fleas.

Experimenting with bugs, Nuttall found that they might contain virulent bacilli but, by injections of their crushed bodies into mice, that their infectiveness died out in at the most about 72 hours. When bugs containing virulent bacilli were made to bite mice, no positive result was obtained. Yamagiwa in a little sore caused in a man by a bug-bite, or said to have been so caused, found the plague bacillus. In several cases Simond thought bugs were most likely to have been the agents of infection. He considers that the transmission of the microbe by means of parasites explains most of the hitherto inexplicable points in plague-propagation. Hankin thinks it is possible that, in order to continue virulent, the microbe has to pass from the rat to another medium, the soil, or stagnant water, or perhaps the body of an insect, and thence to another rat ; but that, in any case, more research is necessary before a positive opinion can be justified.

The rôle of flies would, of course, be confined to taking up, carrying about, and depositing the virus ; but skin-piercing insects may take a more active part in the infection of man. Blood-sucking parasites can obtain blood containing the plague bacillus only from a septicæmic case, primary or secondary.

Mode of entrance of the bacillus.—It has been proved by experiment that the virus can be introduced into certain animals by the unexcoriated conjunctiva or nasal mucous membrane, by the trachea, through the intestine by feeding, through the skin by puncture. In the case of man it has been mentioned above that there is no Bombay evidence that the plague virus can obtain primary entrance by the intestine or stomach ; but the presence of local buboes in certain cases has proved that it can penetrate by the lining of the mouth and naso-pharynx. Most of the Indian observers, except Simond, consider it certain, or almost certain, that pneumonic plague is directly infectious from lungs to lungs. That the virus often gains entrance through the skin is widely believed ; but the difficulty of proving this lies in the fact that the point of entrance is not usually either suspected by the patient or marked by signs of reaction. It has been noticed above, however, that in monkeys inoculated by an infected needle there is no local irritation. And, as a matter of fact, in a number of instances, though not in a majority, points of entrance were found on the extremities, from which points plague bacilli could be obtained, a bubo also existing in the nearest gland-group above the point of inoculation. Cases in which primary skin lesions could be found were estimated by Simond for Bombay at about one in twenty, and for Formosa by Yamagiwa at about one-seventh of the total cases. It is a common opinion that those who go barefoot are more liable to become infected ; and Aoyama asserted that the Chinese, who went barefoot, had nearly always inguinal buboes, the Japanese, who wore shoes, almost always axillary buboes. But Wilm pointed out that the 300 English

soldiers engaged in plague operations at Hongkong worked with their hands, while their legs and feet were protected by clothing, and yet the ten affected had mostly inguinal buboes. Simond gives a table of 61 cases in which primary lesions (phlyctenules) were observed with buboes corresponding. It shows that 51 primary lesions were in the skin of the lower extremity, 43 of them about the foot or ankle, and 19 of them on the dorsum of the foot; and Simond points out that they occurred on places where the skin is thin and delicate, and as such the favourite biting-places for fleas and other parasites. Yamagiwa speaks of one patient who on admission had a small sore on the leg, said to be the result of a bug-bite, and of the finding of the bacillus in this wound. The Austrian Plague Commission, on the other hand, never found a recognisable entrance-place in the skin, and never saw any cases that they considered must have been caused by insect-punctures. They, like others, point out the usual immunity which mosquito-bitten attendants of mosquito-bitten patients enjoy. The German Commission and the Plague Research Committee draw attention to the possibility of self-inoculation in scratching the skin; and the latter say that it is not improbable that plague cultures grow in the *ghee* always present under the nails of natives who eat curry, and that it is a common custom among natives for friends to receive the sputa of the sick in their hands, and to use their hands and clothing in wiping away discharges from the patient's mouth. In opposition to the common view that plague enters by little wounds already existing on the extremities, McCabe Dallas shows that there was an old belief that the presence of open wounds was protective against the plague (General Gatacre's Report, page 96). And it has been mentioned above that Simond failed to inoculate a monkey by a small open wound on the foot. But it is a matter of common knowledge that a wound inoculated at the time it is made is much more dangerous than an older wound placed in contact with a virus. Since the classical cases of Aoyama and Ischigani at Hongkong, several self-inoculations by accidental puncture at *post-mortem* examinations have occurred in India. Cases are mentioned by Thomson (Gatacre's Report), Jennings (Campbell's Report), Simond (the case of Sticker), Weir (the case of Sticker), Clemow, Prall, Green; some doubt, however, resting upon the diagnosis of the two cases reported by Green. There may be other Indian cases on record, and it is possible that a case may have been counted twice from having been reported by two different writers. With reference to such puncture cases it has been customary to say that some doubt must remain as to the reality of the inoculation because plague was prevailing at the time. But as the symptoms appeared within three days of the apparent inoculation, and as appropriate local buboes formed, the doubt here appears to be too scrupulous. Netter and also Manson give some account of some inoculation and other experiments on human beings in Egypt in the beginning of the century. The only case of laboratory infection known is that of Vienna, and both the original and the succeeding cases appear to have been of the primary pneumonic form.

Incubation-time.—So far as is known, it seems pretty certain that in the case of men and monkeys direct inoculation through the skin is followed by symptoms within 3 days; and there is reason to believe that with pulmonary infection the incubation period is much the same, perhaps a little longer. There is no doubt, however, that the time between contact with a sick person and the development of symptoms is often much longer. The probable explanation of such a case is that the subject did not then receive the virus into his system, but carried it away with him, and that the actual inoculation took place subsequently. He could only have carried it away upon his person or his clothes, in the form either of patients' excreta or of blood-filled parasites. It follows that if the bodies and clothing of all suspected persons be thoroughly disinfected during detention, the detention-limit of 10 days adopted by the Government of India is ample.

Propagation.—It is known that plague is propagated from man to man and from rat to rat. There is also strong evidence that it is conveyed from man to rat and from rat to man; in fact, it appears that in India the rat plays in the propagation of plague among men, if not a necessary, at least a frequent, part. It is also known that clothing may be the intermediary of infection between the sick and the hitherto healthy. In the case of plague-pneumonia the disease is probably propagated directly from lungs of man to lungs of man; and it is possible that among rats it may be conveyed from individual to individual by mucous membrane contact. But plague-pneumonia is after all a comparatively uncommon form of the disease, and the difficulty is to explain the method of propagation in the other and commoner forms. It is commonly taken for granted, as has already been mentioned, that the bacillus exists in the soil, and that barefooted men are therefore very liable to infection through casual wounds and abrasions. But, as has been shown above, there is no proof that the bacillus is a frequent inhabitant of the soil, even

of infected places; and there is something strange in the idea that large numbers of the population should have on their extremities little wounds and sores in a condition suitable for the reception of infection, and that such wounds should only admit the plague bacillus. It is well known that wounds that have reached a certain stage of healing are no more, or little more, liable to take up infection than the unbroken skin, and it is also known, not to mention the ubiquitous pyogenic cocci, that in the soil, especially if it be rich in organic material, are very commonly present, very actively pathogenic microbes, such as those of tetanus and of malignant œdema. Of all wounds the most dangerous is that made with an infected instrument, the wounding and the inoculation being simultaneous. It is imaginable that if a man has the virus under his nails or upon his fingers, and scratches himself with sufficient energy, or if the scratched surface happen to have some plague bacilli smeared upon it, or if with the freshly-scratched surface clothing defiled with the bacilli come in contact, that man shall inoculate himself with plague. Now one of the most usual causes of vigorous scratching is the presence of vegetable or animal parasites; and that is one way in which parasites may aid in the spread of the disease. But some animal parasites themselves inflict punctured wounds, and if the insect inject the bacilli into the wound, or puncture with contaminated lancets, or if the bacillus, whether by the agency of the insect itself or not, be upon the skin that is pierced, the result is likely to be plague inoculation. If, as appears, the flea of a man is ready to attack not only another man but also a rat, and the flea of the rat to attack a man, and if an infected flea can bide its time in unworn clothing, great possibilities of transmission are disclosed. This is the line which Simond takes in a reasoned and lucid paper, though the completeness of his scheme is somewhat ahead of the proved facts. His concluding words are:—The mechanism of the propagation of plague comprehends the transport of the virus by rats and by men; its transmission from rat to rat, from man to man, from man to rat, and from rat to man, by parasites. The measures of prophylaxis must, therefore, be directed methodically against each of these three factors: parasites, men, rats.

Conclusions.—Plague is a communicable fever, the virus of which is a bacillus. In a certain small proportion of cases the bacillus enters by the lungs, but for India its entrance by the intestine has not yet been proved. In the majority of cases it appears to enter through the skin, but the mechanism of this entry has not yet been absolutely demonstrated. There is, however, sufficient suspicion attaching to the possible rôle of insects as not only to justify but to call for further research.

History of Plague in India.—The first trustworthy information of the occurrence of plague in India dates from the year 1812, when an epidemic broke out in Cutch and spread into Gujarat and Sind. In 1828–29 a disease absolutely like the Pali plague is reported to have been prevalent at Hansi in the district of Hissar in the Punjab. In 1836 another epidemic broke out at Pali in the Marwar State of Rajputana, and spread over a considerable area causing great loss of life. Along with these isolated outbreaks there exists an endemic centre of plague on the southern slopes of the Himalayas in the districts of British Garhwal and Kumaun. The existence of this centre can be traced back with certainty to the year 1823, and it has frequently since been the scene of outbreaks of varying degrees of severity. The disease is there known as Mahamari.

Koch states that plague is also endemic in Uganda, a part of Africa which is now in touch with India, owing to the employment there of natives of India for military and other purposes.

Plague in India in 1897.—During 1897 the plague continued to spread from Bombay, both creepingly and by springs, the most notable instances of the latter mode of extension being the infection of Karachi, Khandraoni, the Hardwar Union, and the Jullundur and Hoshiarpur districts. While the plague spread gradually from the Bombay and Karachi centres, it at the same time sent out long streamers of exported cases along the Indian lines of communication by land and sea. The extremes for indigenous cases were North Sind, the Punjab, the North-Western Provinces, Hyderabad (?), Belgam, Hubli, and Goa; while imported cases occurred as far apart as Baluchistan, Kashmir, Madras, Hyderabad, and south-west of Hubli.

Plague in Bombay City.—In the beginning of December 1896 there had been a large rise in the amount of plague, and this rise continued progressively until the end of the month. Throughout January 1897, the high figure was maintained, and a further rise

occurred at the end of that month. February saw the height of the epidemic. During March the disease began rapidly to decline, and the epidemic waned steadily throughout April, May, June, and the first-half of July. From the middle of July began the recrudescence, the second great culmination being reached in February and March 1898. The following table is derived from the reports for 1896 and for 1897 of the Bombay Municipal Health Officer:—

Months.	Number of attacks.	Number of deaths.	Percentage.
September 1896	135	79	58·51
October „	406	313	77·09
November „	339	273	80·53
December „	1,664	1,271	76·38
Total ...	2,544	1,936	76·10
January 1897	2,537	2,110	83·1
February „	3,532	3,349	94·8
March „	2,694	2,424	89·9
April „	1,866	1,309	70·1
May „	448	345	77·0
June „	202	104	51·4
July „	72	42	58·3
August „	124	72	58·0
September „	247	171	69·2
October „	290	180	62·2
November „	378	254	67·1
December „	924	643	69·5
Total ...	13,314	11,003	82·6

The highest mortality in Bombay from plague occurred in the suburbs, in the districts of Mahim, Sion, Kamathipura, Parel, Sewri, and Byculla. A lower mortality occurred from plague in the surface-crowded portions of the city than in the suburbs, the explanation being, in the opinion of the health officer, the difference in ventilation. The *chawls* in which the poor classes live have often a gully on one side, and into this gully windows open. In consequence of this, there is more air circulation in the rooms in which they live, even in *chawls*, than in the central and dark rooms in the old-shaped buildings in the suburbs, although these buildings may be in the fields or surrounded by open spaces. The validity of this explanation is decidedly doubtful. Thus, the Plague Committee's Report for 1897–98 states that in Mandvi the plague chiefly occurred in large well-built houses, to few of which on the score of want either of light or of air could objection be taken. In giving the following table for 1897 the Municipal Health Officer mentions that the mortality in some classes cannot be accepted as correct, not only from concealment of cases, but also from imperfect recognition of the disease:—

Classes.	Population by census of 1891.	Number of deaths.	Death-rate per 1,000 of population.
Jains	25,225	373	14·78
Brahmins	37,982	397	10·45
Lingaets	784	26	33·16
Bhatias	7,891	59	7·47
Hindus of other castes	451,465	7,172	15·88
Hindus, low caste	45,169	1,084	23·99
Musalmans	155,101	846	5·45
Parsees	47,458	357	7·52
Jews	5,021	30	5·97
Native Christians	29,712	580	19·52
Eurasians	4,330	42	9·69
Europeans...	11,290	20	1·77
Negro-Africans	146	4	27·39
Buddhists	190	—	—
Other and unknown castes	—	13	—
Total ...	821,764	11,003	13·39

The most correct of the above statistics seem to be those of the Europeans, the Brahmins, and the Parsees. In habitations the number of deaths was generally lowest in the highest rooms of the highest buildings. Such as they are. the figures indicate that the mortality was greater among males than among females, the greatest among males between 35 and 40 years of age. According to the health officer, the experience of 1896 was repeated, in that cases in buildings were generally preceded by the occurrence of the disease among rats, and that the rats appeared almost always to travel from south to north and from east to west, and to infect one side of a street first and then the other, and that plague seemed to stick to places presenting favourable hiding and feeding places for rats, and that measures which, even unintentionally, resulted in the closure of rat-holes and the demolition of rat-homes, were of use in preventing recrudescence of plague in buildings. Just before the rise of the plague curve in July the city had been suddenly crowded by the arrival of about 300,000 or 400,000 immigrants from the mofussil, most of them in search of work. Labour was scarce, and the price of grain very high. Thus many infected or insanitary houses which had been declared unfit for human habitation were unavoidably reoccupied.

It was noticed that the first onset of the disease was rarely rapid in any locality. Isolated, imported and, perhaps, endemic cases occurred from time to time, followed by one or more small groups of endemic cases. Then the disease, having obtained a footing in the locality began to spread, and soon increased with rapidity and virulence, until the place became thoroughly infected. It was also noticed that infection appeared to spread from house to house, neighbouring houses forming groups in which many cases occurred. The infection was hardly ever found at all evenly distributed over the locality.

The origin of the outbreak remains unknown, but, as stated on page 149 of the report for 1896, the suspicion which points to China is the strongest.

Bombay Mofussil.—The figures shown in the Table on page 189 are from returns received in the office of the Sanitary Commissioner for the Government of Bombay, and "do not tally with returns elsewhere published." It is known that these and all other published figures on the subject are inaccurate, and that they err on the side of defect. On page 92 an attempt is made to estimate the amount of the defect, and reasons are there given for believing that it is very great. The following are the districts in the case of which the Sanitary Commissioner mentions the number of towns attacked :—

Districts.	Number of towns and villages affected with plague.
Khándesh	11
Nasik	60
Thána	96
Poona	119
Sholápur	69
Satára	194
Ratnágiri	10
Belgam	6
Karáchi	47
Hyderabad...	23
Shikárpur	42

Several maps have been published showing in a general way the extent of the epidemic. At the end of 1896 plague had not appeared in the districts of Nasik, Satara, Ratnagiri, Belgam, Dharwar, Bijapur, Kanara, Panch Mahals, Thar and Parkar, and Jacobabad. Indigenous cases had been reported in Bombay City, Ahmedabad, Karachi, Bandra, and Bhiwndi towns, and in one village of the Kolaba Collectorate. In Ahmedabad Town the local cases (two in number) were reported at the very beginning of the outbreak there, but the rest were imported. Imported cases only had been reported as occurring in the collectorates of Khandesh, Ahmednagar, Poona, Sholapur, Surat, Broach, Kaira, Hyderabad, and Shikarpur. In January 1897, cases occurred in the districts of Nasik, Satara, Ratnagiri, and Belgam. In February a case occurred in the Thar and Parkar district, and in March two cases in the Jacobabad circle. The first case reported in the Dharwar district was in October, and in the Bijapur district in November. The districts of Kanara and the Panch Mahals alone returned no cases of plague during the year, and the districts of Khandesh, Ratnagiri, Dharwar, Bijapur, Broach, Kaira, Thar and Parkar,

and Jacobabad were but lightly visited. The rise in Khandesh in December was due to the affection of the town of Jalgaon. The Collector of Thana, Mr. Logan, writes :—

" There has not been a single instance in this district where there is even a remote suspicion that " the plague had a spontaneous origin. In practically every case infection can be traced either to a " stranger from an infected place or to a local resident who visited an infected place. . . . There can " be no doubt that the Thana plague entered every place by the agency of persons, clothes, or rats, " which had become infected elsewhere. . . . The plague adhered to the railway, and it almost " confined itself to the area traversed by the local trains, the limits of which are respectively Virar " and Kalyan. . . . That this plague was essentially a *bania* or trading class plague sufficiently " explains why it went further along the Bombay, Baroda and Central India than the Great Indian " Peninsula, the former being the line by which Gujaratis naturally fly. . . . The fact that the interior " of the district escaped scatheless is due, in my opinion, not to its being dry, though that may be " generally true, but to the fact that, firstly, the small villages of the Kunbis offered little accommo- " dation to fugitives from the towns, and, secondly, that owing to a printed proclamation from this " office to every village, the villagers exercised a strict quarantine against all strangers. . . . The " intensity of the plague appears also to have borne no perceptible ratio to general sanitary conditions. " . . . The only satisfactory explanation of the intensity is the liability to infection by a constant " stream of immigration, *minus* promptness and vigour in segregation. Given accommodation for " high caste natives and easy distance for Bombay, infection was everywhere a certainty ; and the " degree of it depended, I should say, almost entirely on the degree of efficiency in the machinery for " stopping the spread of infection."

Writing about the same district Surgeon-Major Anderson, the Deputy Sanitary Commissioner, says :—

" With regard to the mode of conveyance of bubonic plague from place to place, it would appear " that towns and villages remote from an infected centre become infected by human intercourse, while " contiguous places frequently become infected by rats carrying and propagating the disease. . . . In " some instances we find the disease introduced by persons themselves in good health coming from an " infected locality ; and in some of these cases rats died in the houses after the arrival of the people " from Bombay, and before the persons living in the house were attacked."

In the Kolaba district the cases as a rule occurred at coast towns or villages easily reached from the sea-board, and were introduced from Bombay. The Ahmednagar district suffered from famine and plague, the Sholapur district from famine followed by plague. In the Ratnagiri district the villages affected were all near or upon the coast as in the case of Kolaba referred to above.

Plague was first detected in Karachi city early in the month of December 1896. Up to the termination of that year 63 cases and 59 deaths from plague had been reported. These cases were apparently all of local origin, the most careful inquiries having failed to discover the original case or cases importing the disease. At this period the remainder of the Sind Province, with the exception of Kandiaro and Shikarpur, into which towns cases had been imported, was free from the disease. During the year 1897 plague gradually spread along the main lines of communication ; and it was not until the 16th August 1897 that Sind was declared to be entirely free from the disease. During this period 6.057 cases and 4,770 deaths had been reported in the province. Afterwards, however, a second outbreak occurred in Kotri town, the first case being reported on the 28th October 1897. The origin of the outbreak was stated to be unknown ; but the Sanitary Commissioner thinks it probable that the disease was re-imported into the town from an infected area outside the province. Up to the end of the year, 93 cases and 64 deaths had been reported. The last case in Karachi town was reported on the 27th July 1897, the last case in the rest of the Karachi district on the 26th May 1897. One account gives the total for the city of Karachi as 4,086 cases and 3,301 deaths in 1897.

North-Western Provinces and Oudh.—Fifteen cases of plague, other than those occurring in the Hardwar Union, were reported in these provinces in 1897. Of these, eight occurred in large cities. Precautionary measures were taken, and no secondary cases followed. Only seven cases were reported from the districts, but it is quite possible that others occurred of which intimation was not given. From inquiries made by him while on tour the local Sanitary Commissioner is inclined to think that the extensive circulation of information as to the symptoms of plague and the action to be taken may have led to the adoption of the proper procedure of isolating the sufferer in some cases where no report was made of the incident. Interest principally centres round the outbreaks in the Hardwar Union. On the 8th of April the dead body of a woman was seen by the Civil Surgeon of Saharanpur and the Sanitary Commissioner at Hardwar. They arrived at the conclusion that it was a case of plague, and took action accordingly. The deceased had only occupied the hut for two days, and on searching the pilgrim lodging-house from which she had come a woman was found recovering from a severe illness and with a suppurating bubo in the groin. It was a time of much anxiety, inasmuch as the

great fair was in progress, and nearly 200,000 pilgrims were collected in the town. However, all passed off well, and the great collection dispersed without disseminating the disease. Subsequent inquiries led to the conclusion that the disease had been introduced a short time before by pilgrims from Sind. On a thorough examination of the houses in the neighbourhood of the pilgrim lodging-house above referred to three more cases were discovered, and up to the 22nd April the total number was eight. Between the 22nd April and the 16th May no cases were reported; but on the 16th May a *pujari* who had visited, and probably slept in, the infected area, died of plague, and afterwards nine more cases occurred, the last on the 8th June. Eighteen cases in all occurred. The first seven cases occurred within 130 yards of one another in a definite portion of the town, the evacuation of which for purposes of disinfection was possible. Within a mile and a half of Hardwar is situated the town of Kankhal, with some 6,000 inhabitants, and much communication exists between the two centres of population. About the middle of June an unusual mortality among rats was observed at Kankhal, and the government bacteriologist discovered the plague bacillus in some of them. Steps were taken to obviate the threatened danger, and it was at first hoped with success. But in the first week of September the special plague medical officer, who had been left in charge of this town, had his suspicions aroused that all was not right, and on the 16th of the month an undoubted case of plague was reported. About the middle of October an alarming development was the occurrence of the disease among the hordes of monkeys which infest this town. Subsequently Messrs. Hankin and Haffkine found the bacillus in the dead bodies of some, though most of the examinations gave negative results. In the case of the human inhabitants of Kankhal the diagnosis of plague was also confirmed by bacteriological examination. In all 64 cases occurred, distributed over the greater part of the town, but so grouped together as to form definite *foci* of the disease, which were made the basis of the proceedings taken for the evacuation of infected localities. By the third week in December the outbreak was practically at an end, and early in February 1898, the town having been disinfected, the people were permitted to return to their houses. Meanwhile the disease had appeared in certain villages in the vicinity; but it was not till the 9th of January 1898 that it broke forth in the town of Jawalapur, $2\frac{1}{2}$ miles distant, and with 15,000 inhabitants.

Punjab.—The origin of the plague in the Punjab is involved in some obscurity. The following account is principally derived from the Sanitary Commissioner's report:—

"In February a Brahmin named Ram Saran left Khatkar Kalán, a village of 1,200 inhabitants in "the Nawashahr tahsil of the Jullundur district, for the purpose of making a pilgrimage to Hardwar, "a place in which the first case of plague was discovered on the 8th of April. He returned to his "village on the 29th of April, and it is reported that he stayed one night at Rahon (another village "near Nawashahr) on his way back, and that it was here the symptoms of the disease first showed "themselves. By the time he reached his home he was very ill with high fever and delirium, and "after a few days' illness he died. The people of the village in this case apparently recognized that "he was suffering from some new form of fever, of which they had no previous experience, but it "was not reported at the time. Shortly after the death of the first case a Brahmin woman was "attacked (a relative of Ram Saran), by name Mussammat Málin, who lived near a large well situated "in this part of the village, and subsequently there were a few more cases of severe fever which "caused no anxiety to the villagers, as they were ignorant of its nature, and there was no tendency "to an epidemic. At the end of July or the beginning of August, however, rats were noticed to be "dying in a curious way in some cattle-sheds belonging to a zamindar named Hari Ram, situated not "far from the well referred to, but beyond noticing the fact it does not seem to have aroused any "suspicion whatever in the minds of the villagers, so far as has been ascertained, or if it did it was "certainly kept quite quiet.

"In September the Chamárs, who live on the west side of the village, and whose houses adjoin "those of the Brahmins living near this well, became affected. The disease then began to spread "more rapidly, and by October had taken on the characters of an epidemic, and the villagers now "realized that they had an infectious and very fatal form of disease among them. On the 14th "October four deaths took place, which thoroughly frightened them, and a report was sent to Banga "Thana, and the Hospital Assistant at the dispensary went at once to the village, and as the result of "his investigations he reported the disease as plague. The Civil Surgeon, Jullundur, then went to "the village and expressed the same opinion.

"On the morning of the 18th October the Sanitary Commissioner received a telegram from the "District Superintendent of Police to the effect that plague had appeared in Khatkar Kalán, and "immediately instructed the Deputy Sanitary Commissioner to meet him at Jullundur, and together "they visited the village on the 21st October, when the disease was officially announced as plague. "The last case at Khatkar Kalán occurred on the 4th December 1897.

"After Khatkar Kalán had been declared free of plague, cases were found in other villages, which "showed that the disease had spread, as on the 2nd November Jhandher Khurd, a village west of "Banga, and about six miles from Khatkar Kalán, was found to be affected; the Chamárs, who were "the first to be attacked, being related to the Chamárs of Khatkar Kalán. It was dealt with in the "same manner, and there were here only 29 cases and 18 deaths altogether, the last case occurring on "the 19th December, the total population of this village being 395. On November the 24th plague

" was discovered in Khán-Khána, a large village containing 2,500 inhabitants, but it is almost certain " that it was present in this village some time before it was reported by the village headmen. The " villagers at first were not inclined to leave their houses, as they hoped that segregating the sick " would be sufficient to check the disease, but a very rapid increase in the number of seizures (96) " during the following fortnight caused them to understand their danger, and in the end they asked " to be put out into camp. This was done, and by December 6th everyone was out and the village " deserted. After the evacuation of the village the disease, as elsewhere, declined, but not so rapidly " as in the other villages, a fact probably due to the firm hold of the place the disease seemed to have " obtained, as well as to the large number of persons under treatment, and to the cold weather which " made the people huddle together more than they had previously done.

" The next place the disease appeared was at a village named Berámpur in the Garhshanker tahsil " of the Hoshiárpur district, about ten miles distant from Khatkar Kalán, the outbreak being reported " on December the 11th. In this case the source of infection was distinctly traced to Khatkar Kalán, " as a sweeper's wife ran away from that village when her husband was attacked, and she subse- " quently became ill and died at Berámpur. It is reported that she escaped from Khatkar before a " proper cordon had been placed round the village, and from the investigations and inquiries subse- " quently made by the officers detailed for duty in the infected area, there seems reason for thinking " that two, or possibly three, villages were infected before it was realised that there was plague in the " district. Khatkar Khurd was found to be affected on the 28th December, and had 10 cases.

" Up to the close of the year there were altogether four villages in the Jullundur district and one in " Hoshiárpur attacked, 274 cases and 155 deaths occurring in the Jullundur villages, and 28 cases " with 20 deaths in the Hoshiárpur one. The disease thus spread slowly in the province, just as it " has done in Bombay and elsewhere, and it was only in the month of February 1898, after heavy " rain had fallen, that it made a sudden rise, spreading more rapidly to other villages with increase " of cases.

" 'There seems to be no doubt,' says the Deputy Sanitary Commissioner, 'in the minds of the " 'villagers that Ram Saran brought plague into their midst, and the impression is strengthened when " 'we remember that there was plague at the time at Hardwar, where the man had been. The " 'disease was at first confined to the Brahmins, to which caste he belonged, and there seems to have " 'been a regular sequence of cases from Ram Saran to the Chamárs who were found with the " 'disease on them when we arrived. Further evidence was found when the people evacuated the " 'village between October 24th and 26th.

" 'Up to this time none of the Rawals had been attacked. They lived in a separate 'patti' or " 'section of the village, cut off from the rest, and had quite a different entrance to the Brahmins. " 'But after they got out a woman named Barkat, wife of Nabbu, was attacked and died. As it was " 'impossible for the infection to have arisen in the new healthy camp, the inference was that she " 'became infected from the village. On going to her house, which lay at the very end of a long *cul* " '*de sac*, we were surprised to find that it adjoined, back-to-back, Ram Saran's house. In fact the " 'two houses were under the same roof. The Rawal family had no connection whatever with the " 'Brahmins. This infection of houses adjoining others in which plague has occurred is so common " 'that towards the end of the epidemic in the Banga district we made special arrangements for the " 'disinfection of all houses surrounding, and especially those back-to-back to 'infected' houses.' " 'The agency of communication is probably rats. But whatever the agency may be, the fact remains " 'that houses touching infected houses, although, as in this case, having their entrances in different " 'streets and occupied by people totally different in caste and habits, are especially liable to infection."

After having found some further evidence the Deputy Sanitary Commissioner concludes:—

" In short, all Ram Saran's surroundings seem to have been ultimately attacked."

In reviewing the evidence of the whole provincial epidemic, the Deputy Sanitary Commissioner thinks that it is pretty clear that human agency is the chief cause for the spread of the disease from village to village, and that any means which stops or hinders people from leaving an infected locality will also tend to prevent or retard the spread of the disease. There were also facts to show that, though it may not be a common mode of infection, rats may sometimes carry infection from one village to another. On the other hand, facts indicated that in the spread of plague *within* a village, though human intercourse was an important factor, rats played an equally important part; and that, after a village had been evacuated by its human inhabitants, a continuance of the epidemic among the rats remaining behind might lead to a more widespread infection of houses than existed before the evacuation. In the Punjab in 1897 there were reported 312 cases and 179 deaths, of which 302 and 175 belonged to Jullundur and Hoshiárpur, and the others were scattered imported cases.

Madras Presidency.—A racing party that had visited Poona was affected. A case of plague from amongst them was taken from the train at Guntakal and another at Arkonam. A third case underwent incubation in Madras whilst on the observation list. He died of the disease. In their eagerness for ascertaining the conditions in this—to them new—disease, a *post-mortem* was conducted by two medical officers; one had an abrasion on his hand, and was duly affected with symptoms indistinguishable (*see* above under "Mode of entrance of the bacillus") from plague; an attendant pricked his hand during the *post-mortem*, and died of this disease. This menial absconded from the hospital, but was luckily traced by the health officer. Under the system of observation in force the whole of the persons connected with the outbreak were readily traced and carefully supervised.

The man received at Arkonam ultimately recovered. Some cases in this presidency reported as probably plague, turned out on investigation to be instances of anthrax in the human being.

Gwalior.—The outbreak in the village of Khandraoni affords a typical and well-defined instance of the diffusion of the disease by human individuals. Khandraoni is a small village situated in the Gwalior State and distant about twenty miles from Jhansi. The population in July 1896 was 558. For some years past several of the inhabitants of Khandraoni had been in the habit of going to Bombay and taking service there, revisiting their village at intervals; among these were two Brahmins, Bindraban and Khoobi, the former being one of the headmen of the village. These two Brahmins came from Bombay to Khandraoni in January in 1897, at a time when the epidemic was virulent in Bombay. They travelled straight from one place to the other and arrived at Khandraoni on the 9th of the month. On leaving Bombay Bindraban was suffering from fever, and Khoobi attended him on the way, bringing him to Jhansi by rail and from there, in a country cart, to Khandraoni, where he died five days after his arrival. Two days after Bindraban's death, Khoobi fell ill and died in three days, and almost a week after his death a native doctor of the village, who attended the two Brahmins, was attacked with fever and died, and at the same time a second native doctor, who came from another place to treat the first doctor, also succumbed to the disease. The plague then gradually spread amongst the inhabitants of the village, and by the 18th March, 59* seizures had occurred, of which 47* had proved fatal.

Garhwal.—The last outbreak in Garhwal, which occurred in the spring of 1897, occasioned particular notice and anxiety, as it was contemporaneous with the worst period of the Bombay plague. The locality was a small village near Okhimath on the main road of pilgrimage from Hardwar to Kedarnath, and some 20 miles distant from the latter place, which was the scene of the 1823 outbreak.

At the commencement of the attack some of the inhabitants, following the usual practice in such cases, left the village, which was very small, remote, and inaccessible, and thus escaped infection. Only four or five families remained, most of the members of which died of the disease. There were 17 deaths in all.

Plague elsewhere.—Most of the districts or places where plague occurred in 1897 have already been mentioned, and the following completes the list, with the exception of the Portuguese possessions of Daman and Goa, in the former of which the outbreak was severe:—

YEAR.	Cutch.		Hyderabad.		Central Provinces.		Rajputana.		Baluchistan.		Kashmir.		Central India, excluding Khandraoni.	
	* Cases.	Deaths.	‡ Cases.	Deaths.	† Cases.	Deaths.	† Cases.	Deaths.	† Cases.	Deaths.	† Cases.	Deaths.	Cases.	Deaths.
1897...	6,653	5,709	24	8	16	11	51	44	2	1	1	—	21	11

* Imported and Indigenous. † Imported only. ‡ Imported and perhaps also indigenous.

The first case reported to have been landed from Bombay at Mandvi, the principal seaport of Cutch, was on the 3rd of October 1896, but indigenous cases were not reported there till the 9th June 1897. The first place to suffer to any extent from indigenous cases was Rawapur, which was infected from Karachi by a dirzi, who gave the disease to 11 of his relatives, all of whom died. Mandvi is in direct and constant communication with Bombay and Karachi; and most of the other villages of Cutch affected at first were within easy distance from Mandvi and the coast. The disease does not appear to have taken root in every place to which it was imported. The epidemic reached its acme in May, and then declined rapidly; but there was a recrudescence in August and September, and cases continued to occur up till the end of the year. It is said that vegetarians were more affected than meat-eaters.

* Now given as 74 cases and 52 deaths.

Conclusions.—In its long distance marches plague seems to have spread along the lines of communications—coasting steamers, railways, roads, rivers—and in this case man, in person or clothes, was the agent of diffusion. Between the houses and streets of a town or village, and even between closely neighbouring villages, the disease was often carried by rats also.

Measures for India.—At the end of January, when the plague had, in spite of all precautions, taken a firm hold of Bombay, when it had become epidemic in Karachi, and when it had begun to spread to Poona, Ahmedabad, and other places, it became evident that the ordinary provisions of the law were not sufficient to enable the local authorities to enforce all the measures necessary for grappling with the disease where it already existed, and for preventing its spread to other districts, provinces, and countries. Accordingly, the Government of India determined, having regard to the high mortality resulting from the plague, the persistence of the disease in Bombay and Karachi, the apprehension that it might spread and become epidemic in other places, the injury that was resulting to the trade of the places affected and the country at large, that it was necessary to take special powers by legislation. With this object a bill to "provide for the "better prevention of the spread of dangerous epidemic disease" was introduced in the Council of the Governor-General on the 28th January and passed into law as the Epidemic Diseases Act (III. of 1897) on the 4th February. The intention of the Government of India in passing the Act was that regulations for dealing with the epidemic should, subject to the general control of the Governor-General in Council, generally be made by the Local Governments, who, with their greater local knowledge and experience, and with their greater facilities for gauging local opinion and enlisting local sympathy, were in the best position to devise regulations to meet the particular circumstances which had arisen and might arise in the territories under their administration. Therefore, on the day that the Act received the force of law began the issue of the necessary series of notifications conferring powers on Local Governments and Administrations. The Government of India itself found it necessary to take action under the Epidemic Diseases Act only in four classes of cases; issuing orders referring to the prohibition of the pilgrimage to Mecca, to the prohibition of emigration from India, to the temporary prohibition of the booking of railway fares to certain localities with a view to prevent the assemblage of large religious gatherings, and to the prohibition of the importation of certain articles likely to carry the seeds of infection from the Bombay Presidency to other parts of India.

The preventive measures actually adopted may be divided into the following classes:—

(1) *Measures to suppress the disease in plague centres.*—Arrangements to ascertain the existence of plague cases by compulsory report, registration at burning and burial grounds, house to house visitation, inspection of corpses, and other means; the treatment of plague patients in special hospitals constructed with a view to the segregation of the sick; the disposal of corpses in a manner calculated to prevent their breeding infection; the segregation of persons who had been living with persons suffering from plague; the evacuation of infected buildings and localities, and the accommodation of their evicted inmates in carefully-supervised health camps; the disinfection and cleansing of houses in which cases of plague had occurred; the disinfection of contaminated articles, or their destruction if they were of little value; the exposure of insanitary and infected dwellings to light and air; the demolition of insanitary and infected huts; the general disinfection and cleansing of the locality; the general improvement of drainage; and other sanitary precautions, such as the abatement of overcrowding.

(2) *Measures to prevent isolated cases establishing a fresh focus of infection.*—These were similar to those described above. They consisted mainly in the segregation of the sick, and of those who had been in contact with them; the disposal of the corpses in a safe manner; the disinfection or destruction of contaminated clothing, bedding, and other articles; the disinfection of contaminated conveyances; the evacuation of the dwellings in which cases had occurred, and their disinfection or destruction; the evacuation, if necessary, of the locality; and the adoption of general sanitary precautions.

(3) *Measures to prevent the spread of infection by persons travelling by land.*—Land quarantine was not imposed; but all persons travelling from infected localities by rail, road, or river were examined by a medical officer, who was given a wide discretion to retain under observation, in suitable and isolated shelter,

all persons considered to be likely to spread infection by reason of the symptoms, their appearance, or the state of their clothes or personal effects, and persons without a fixed abode and who were not likely to be traceable or to give information of the occurrence of plague cases amongst them. This inspection was in general carried out on departure from the infected locality or area, and on the route or at the place of destination.

The whole of India was protected against the Bombay Presidency and Sind by a series of inspection stations on the main lines of railway traffic. Arrangements were also made to keep a watch at their own homes over persons arriving from infected districts. An additional, and very necessary, precaution was the disinfection of the clothing and baggage of travellers from infected areas, which from its condition or other reasons was deemed to be dangerous. Rules were also promulgated for the disinfection of railway carriages. Precautions similar to those adopted on the railways were put in force in the case of travellers by road and by river routes.

(4) *Measures to prevent the spread of infection by persons travelling by sea.*—Vessels sailing from ports in the infected areas, and, in the case of vessels sailing for ports out of India, from other principal ports in India, were inspected before departure, and any cases of plague discovered on board were removed. Quarantine was also impressed against the infected ports at other ports in India. The original rules enforced at the ports of arrival were issued under the Quarantine Act (I. of 1870) and were similar to those enforced against Hongkong in the year 1894. Revised rules were subsequently issued under the Epidemic Diseases Act (III. of 1897), based on the regulations prescribed by the Venice Sanitary Convention of the 19th March 1897. The rules for the medical inspection of vessels before leaving port were also revised after the issue of the Convention.

(5) *Measures to prevent the spread of infection by susceptible articles.*—The importation of rags, used apparel and bedding, waste paper, and used gunny bags, from the Bombay Presidency and Sind to other parts of India was prohibited, both by land and by sea. Precautions were also taken to prevent the spread of infection by grain and other food-stuffs.

Measures in the Bombay Presidency and Sind.—A first set of general regulations under the Epidemic Diseases Act was issued by the Government of Bombay on the 20th February. A number of additions were made to the rules in the light of later experience, and the whole series was afterwards consolidated in a notification dated 29th March.

The general course pursued was, as regards preventive measures, to hinder those coming from an infected area from entering a healthy town or village, by detention at an observation camp till freedom from infection was assured, and the person and personal effects disinfected. When the disease was apprehended, or had appeared, in a town, usually a small committee with full powers supervised the whole proceedings. Otherwise in a district the collector managed the business. The town was divided into wards, each with a superintendent in charge, with suitable assistance, which comprised a searching staff, a medical staff, and a cleansing staff. The searchers, under carefully framed rules, visited the houses, and if any sick were found, the medical staff were called in to diagnose the case, which, if considered plague, was removed to hospital, the other inmates of that house being placed in a segregation camp to be disinfected and remain there for 8 or 10 days. The cleansing staff then cleaned and disinfected the infected building. In some instances in large towns, instead of searching daily, the superintendent watched the daily number of deaths, and kept a list of the sick, any suspected case being examined. If the number of deaths mounted up, the ward was searched, and, if it could be done, the people were turned out into camp. As a rule, all the houses were cleaned and opened up either by the staff or the owners, and sanitation strictly attended to. All deaths had to be reported, and, if the cause of death was not clear, a medical inspection was made. In large towns, every now and again, without warning to the people, the whole searching staff was concentrated on a given ward, a cordon having been put round to prevent ingress or egress, and the whole place rapidly and thoroughly searched with a minimum of inconvenience to the people ; and this measure was very useful in those cases in which wards had become seriously affected. Another good measure, though it could not always be put in force, was to turn the whole ward out into a camp, whilst the houses were cleaned and opened up to light and air. The evacuation of infected localities and the lodging of the inhabitants in health camps were special features of the work in Sind, and were adopted

elsewhere. In addition, at various points on the railway, inspection stations were organised, and travellers examined ; and, according to the rules in force, either only those who were sick were detained or all travellers were detained for a fixed period, disinfection of the person and effects being also carried out.

Measures in the City of Bombay.—Until the appointment of General Gatacre's Committee on the 9th March, the remedial and preventive measures were carried out by the municipal authorities of the city. That committee was directed to strive after the discovery of all cases of plague ; the treatment of all cases in hospital ; the gradual segregation, as far as possible, of the probably affected—that is, of those living in the same room with, or in close attendance on, persons suffering from plague ; but on the understanding that the social, caste, and religious usages of the people should be treated with all consideration. The city was divided by the committee into 10 districts, and these again into sub-divisions, to each being assigned an appropriate staff and plant. In addition to the death registration and report rules, the main agency employed for detecting cases of plague was the system of house-to-house visitation. When a suspicious case was found, the medical officer was called on to certify as to whether it was a case of plague or not. If the case was diagnosed as plague, the ambulance was brought to the door of the house, and the stretcher to the room of the sick person, if the width of the doorway or the incline of the doorway staircase permitted of this being done. Special attention was bestowed on the ambulances used to carry the sick to hospital, with a view to minimise the risk of the transit. A large number of well-equipped hospitals was established and maintained, and efforts were made to overcome the reluctance of the population to the hospital system by the establishment of numerous private hospitals. General Gatacre stated that the moral and practical support which the committee received from the establishment of private hospitals was invaluable, as it quelled at once the misgivings and fears entertained by the people with regard to the hospital system. In the disposal of corpses the matter principally looked to was the condition of the burial-grounds. The actual disposal of the bodies of persons who died of plague was left, as far as possible, to the relatives and friends of the deceased, who performed the last rites according to the custom of their sect, subject only to such sanitary supervision as was essential. One of the standing rules for observance in hospitals was that the body should be wrapped in a sheet soaked in solution of perchloride of mercury before being handed over to the friends of the deceased. It is to be gathered that all persons who occupied the same portion of a tenement or the same house as the sick person were compelled to vacate the room or house to allow of its disinfection, and that they were in general segregated in the neighbourhood of the hospital in which the sufferer was being treated. The disinfection of the house formed the sequel to a visit with positive results. The committee, during disinfection, invariably treated those places where rats had been known to die as plague-infected localities. In addition to the thorough treatment of single houses, large measures of cleansing and sanitary reform were continuously executed. At one time as many as five thousand special workmen were employed on these operations.

From July, in which month began the recrudescence of the plague, the work of the Plague Committee was continued under the presidency of Sir James MacNabb Campbell. The aims set before it were to keep down the death-rate, while preventing panic and trade dislocation, and to lessen the risk of a third epidemic. To lessen the risk of a third plague epidemic, in addition to the removal of the sick, the segregation of the tainted, and the cleansing of the house, special attention was paid to the construction of camps as a relief from overcrowding, to the vacation of infected and unwholesome houses, and to the introduction of an improved provision of light and air. Apart from the cleansing of streets, the flushing of gullies, and the other general preventive measures which were efficiently carried out by the Health Department, so far as pure plague operations are concerned, the main hope of a low death-rate lay in securing the removal to hospital at the earliest possible stage of the attack. The means adopted by the committee to secure the early removal of the suffering were—information, simple house-searching, and house-searching with cordons. All these were made less effective than they might have been by the action of the people in wilfully concealing cases. "Contacts," that is, those persons who had lived in the same room or house as a patient, or had been in close association with him, were treated on the same lines as plague cases. They were removed with all their belongings to a contact camp, where they passed through a complete process of disinfection, which was applied to their persons, clothes, and moveable property. If plague cases appeared among them, these again were removed to a hospital, and the same measures for elimination and disinfection were again applied to those who had been closely associated with them, and who were therefore designated "Recontacts." This process

was again repeated, if necessary, until it was found that plague had actually been dispelled; a result which was usually attained within the first week, the majority of plague cases among "contacts" occurring within the first four days. The affected houses were treated by the several agencies of fire, disinfection, ventilation, and exposure to sunlight and air. The disinfectant most used was perchloride of mercury. When many cases of plague occurred in a house, a large *chawl*, or in a group of crowded dwellings, or when the conditions of such dwellings were so insanitary as to invite outbreak of plague, the complete vacation of such dwellings, and the removal of the inhabitants together with their property to a health camp, after the "contacts" had been set apart, was a most effective mode of attack on the epidemic. Since August 1897 one chief object of the Plague Committee had been to provide abundant and healthy accommodation in camps, both for infected arrivals and for the evicted dwellers of tainted and unwholesome buildings in Bombay. Experience in previous epidemics, both in Bombay and in the mofussil, had shown that the most efficient means of keeping the plague in hand was to remove people, as much as possible, from infected areas into camps. For this reason the committee encouraged private camps in the case of the well-to-do, and constructed public camps on available open spaces in and about the city, in which to place the indigent. Besides the contact camps and the health (public and private) camps, there were also detention camps for travellers wishing to enter the city, and observation camps for travellers wishing to leave it.

As showing the activity which characterised the work of the committee in Bombay, it may be mentioned that during the six weeks before the middle of March on an average 2,951 houses were daily searched and 106 plague cases daily discovered and taken to hospital; that on an average 100 deaths out of a daily recorded plague mortality of 195 took place in hospital; that 88 "contacts" were daily placed under surveillance in camp, and about 200 (as attendants on their friends) in hospital; and that 161 infected dwellings were disinfected and 78 vacated, the bulk of them being large buildings.

Measures in Poona.—Certain measures had already been carried out; but by a resolution of the Government of Bombay of the 9th March a committee was appointed with Mr. Rand as chairman. A great difficulty for the committee was the want of labour to carry out the operations. To meet this emergency a carefully devised and systematic plan of operations was elaborated, and carried out with the assistance of volunteers from the British and native troops stationed at Poona and Kirkee. The city was divided into a number of districts to facilitate the systematic prosecution of the measures it was decided to enforce. These measures consisted mainly in the detection of cases and the removal of the sick to plague hospitals; the removal of persons who were apparently healthy, but had been exposed to plague infection, to segregation camps; the disinfection of houses and moveable property which had been exposed to infection. Five hospitals and four segregation camps were established, and military parties were constituted for the search for plague cases, the removal of the sick and the possibly infected, and the disinfection of houses. Municipal agency was employed collaterally with the military. Notwithstanding determined and embittered opposition culminating in the assassination of Mr. Rand, the operations were carried out to a successful issue. After the recrudescence of the disease in July measures generally similar were employed.

Measures in Karachi.—From the beginning of January the disease increased rapidly, and the question of the evacuation of the infected quarters was then taken up with serious attention; and when Mr. Wingate paid a visit, on the 23rd January, he found a health camp had just been occupied by 2,000 Nasarpuris, a sect of well-to-do Hindus. At the end of January the operations in progress were cleansing and disinfecting streets and lanes; vigilant house-to-house inspection; supervision of burial and burning grounds; thorough disinfection of plague-infected houses; destruction of infected clothing; burning of infected huts; preparation of large health camps, and persuasion of the inhabitants to move into them; ventilation of houses by making holes in the roof and walls. There was practically no segregation of the sick and no medical treatment. The disinfecting work had also fallen into arrears. To remedy this last important defect, supervising officers were appointed, and the lost ground was soon regained. Every house was emptied as soon as it became infected, the sick person being left with one or two attendants, and the rest of the occupants moving to camp. The house was then disinfected. By the 11th of February the arrear work in disinfecting houses had been overtaken, and the operations had been carried in advance of the plague by the cleansing

of places which had not yet been attacked. The beginning of February was also marked by the first efforts to bring medical aid to the sick, and to segregate them. By the end of February the collector reported that few cases now remained undiscovered, and hence the removal of the healthy was at once universally carried out. On the 20th March His Excellency Lord Sandhurst visited Karachi, and, after inspecting all that had been done, appointed a plague committee, with Brigadier-General T. A. Cooke as president. Details with regard to disinfection of men and their clothing and effects at the camps and to camp-control was carefully elaborated by the committee. On the 25th March the first military search party went out. It was very carefully organised and admirably managed, the civil officers accompanied by medical men taking charge of each party. The general had carefully instructed the men, and from that day forward there was no need for the slightest apprehension, either that the soldiers would not deal tenderly, or that the people would not welcome them : not a complaint was ever preferred. From this time onwards the epidemic steadily decreased, and the operations, which had been gradually and cautiously introduced, were carried to their successful termination.

Measures in the North-Western Provinces and Oudh.—Regulations were originally promulgated by the Government of the North-Western Provinces and Oudh on the 12th February 1897, but were revised and issued in their final form on the 26th March. These dealt with the duties of the various official and non-official classes of the community in the matter of prompt reporting of cases ; with the action to be taken in municipalities and cantonments, not only on the appearance of plague, but also in anticipation of the same ; and with the procedure to be adopted for watching the rail-borne traffic from infected areas. With the second part was issued a memorandum by the Sanitary Commissioner describing the symptoms of the disease, and the procedure to be adopted in villages and small towns. Directions for the disinfection of houses, furniture, &c., in localities in which plague had appeared were also issued in a separate circular from the Sanitary Commissioner.

Measures at Hardwar and Kankhal.—The first outbreak occurred at Hardwar in April, and was probably due to infection carried by pilgrims from Sind. Special arrangements were made for dealing with the large number of pilgrims expected to attend the fairs, and for preventing, if possible, the importation of plague by pilgrims coming from infected areas. In addition to the ordinary examination of railway passengers in accordance with the Epidemic Diseases Act, every passenger was examined at Pathri station close to Hardwar. Those pilgrims found to have come from infected areas were sent on to Hardwar in locked carriages, and were kept under observation on Rori island. Pilgrims coming by road were also inspected ; and the sanitary arrangements of the town and the fair-site were carefully attended to. Provision was also made for the accommodation and segregation of the sick and their relatives and attendants. A reporting agency was appointed, and is believed to have worked well. On the occurrence of the eighth case (in April) it became clear that further measures of a more stringent nature were required. The Lieutenant-Governor decided that the infected area (*i.e.*, the area in which all the cases but one had occurred) should be placed in quarantine and evacuated, the inhabitants either leaving Hardwar altogether after examination by, and with the permission of, the health officer, or removing to a camp of observation established at some distance from the town in charge of a medical officer : the names and addresses of those leaving being forwarded to the authorities of the district of destination ; that after evacuation the houses should be thoroughly cleaned and disinfected, and should not be re-occupied till declared safe ; that all dead bodies should be examined by a medical officer before burial or cremation (as a further safeguard against concealment of plague) ; and that all pilgrims to Hardwar from infected places should reside in a special camp under medical observation. Pilgrimages to the fairs in May and June were discouraged. All this time the utmost care was bestowed on the cleanliness and sanitation of the town, and the lime-washing and disinfection of the houses was carried out without intermission. But on the 16th May occurred the first of the ten cases that ended the outbreak. This led to redoubled efforts to secure the detection of cases, and to carry out all possible sanitary improvements and disinfectant measures. Mr. Hankin was recalled from Bombay for the purpose of studying the cases bacteriologically. While special attention was thus paid to Hardwar itself, the neighbouring places were not overlooked. No cases occurred after the 8th of June.

In the case of Kankhal the following precautions to prevent the transmission of the disease from infected rats to men were adopted. In the case of any house or godown in

which rats were found to be dying in unusual numbers, the house with its contents and the neighbouring drains and premises were thoroughly disinfected in the same manner as if a case of plague had occurred; any grain, sugar, raw food material found in large quantities in such houses was exposed to the sun and air for eight hours, being carefully turned over at intervals, and then locked up in a specially disinfected room for ten days before being used for food; when in small quantities, such materials were destroyed; sacks, baskets, and other receptacles were either disinfected or destroyed; the inhabitants of such houses were induced to vacate them for ten days; and a reward of two annas per head was at the same time authorised for every rat living or dead brought in. In the town of Kankhal large quantities of grain are kept; and it was a matter of great importance to prevent these stores from becoming infected through plague-stricken rats. It was settled that such stores of grain should be thoroughly aired in the sun, and the godown or store-rooms well disinfected before the grain was again replaced in them. It was considered unnecessary to issue any orders for the destruction of grain. When plague appeared in September, the methods and machinery which proved successful at Hardwar were at once brought into force. An alarming development was the occurrence of the disease among the hordes of monkeys which infest this town. As many of these animals as possible were captured by means of "*kanjars*", and kept in cages under observation until such time as they were shown to be free from disease, when they were released in the jungles at a considerable distance from the inhabited area. These measures proved successful. By the third week in December the outbreak was practically at an end, and early in February, the town having been completely disinfected, the people were permitted to return to their houses. Meanwhile the disease had appeared in certain villages in the vicinity. A special organisation for keeping an area of some 400 square miles round the original focus of the disease under close observation was at once originated, and each fresh centre of disease was dealt with as discovered. This scheme was of great value.

Measures at Khandraoni.—At Hardwar measures of segregation, evacuation, and disinfection were successful in stamping out isolated cases before they had grown into a serious epidemic. At Khandraoni similar measures carried out on a small scale in a very thorough manner were successful in arresting almost immediately an epidemic which had become virulent in the confined area of a small village. A nominal roll of the villagers having been prepared, they were divided into four classes—those families in good health among whom no cases of fever had appeared since the 9th January; those families in good health among whom cases of plague or fever had occurred since the 9th of January; those families in which there were cases convalescent from plague or fever; and those families that contained members then suffering from plague or fever. By the aid of the military, and with very strict precautions, the village was evacuated, and the four classes were separately segregated in camp, the sick being placed under medical attendance. Very thorough arrangements were made for the discipline and complete isolation of the camps, and for the supply of food, &c. No strangers were allowed to enter the village. At the time of the evacuation of the village, hay and other inflammable materials were placed in the infected houses and those in their immediate vicinity, and they were then set alight and destroyed, care being taken that nothing that could be burnt escaped. The cleaning and disinfection of the village was delayed until the place had been exposed to the disinfecting action of the sun and air for three weeks, with a view to remove any danger of the persons engaged in the operation contracting the disease. Detailed measures were taken to prevent the spread of infection to the neighbouring villages, or its importation into them from Bombay. Complete success attended the operations so carefully devised and carried out, and in a very short time the epidemic was extinct. On the day that Surgeon Lt.-Col. Crofts, I.M.S., who planned and superintended the measures described, arrived there were eleven persons ill of plague. After that date there were only four admissions to hospital, all of which occurred within ten days of the formation of the segregation camps. The village having been thoroughly cleansed and disinfected, no case of plague having occurred since the 1st April, and no deaths since the 11th, and the patients under treatment having recovered, the segregation camps were broken up on the 29th of the month. Before this was done, every man, woman, and child in the hospital camp was obliged to bathe, and to exchange the clothes he or she was wearing for new ones, which were supplied free. The hospital huts, patients' clothes, blankets, beds, and all other articles of a combustible nature were burnt; and the only things brought out of the hospital camp were money, jewellery, metal cooking utensils, and the new clothes given to the occupants.

Measures in the Punjab.—The Government of the Punjab issued two sets of general regulations on the 8th of March. The first empowered the District Magistrate to adopt the various remedial and precautionary measures which experience had shown to be necessary. The second provided mainly for the immediate report of the existence of cases of plague. With these regulations the Government of the Punjab issued a set of executive instructions prescribing the precautionary measures in detail. On the 19th of June a further set of practical instructions was issued in the form of a circular letter.

Measures at Khatkar Kalan and Khatkar Khurd.—On the 21st October, when the disease was officially announced as plague, a cordon was placed around the village, and the necessary measures were started for dealing with the epidemic. During the following week the entire population of the village was turned out into camp, and hutted in suitable grass huts within the village area. The sick were treated in hospital, while their relatives and all who had been near infected persons, were accommodated in a special camp (called "the segregation camp") within easy reach of the hospital. The remaining population was placed in another camp known as "the health camp"; the Muhammadans, Hindus, and lower castes being all in separate divisions, and arranged so that no disputes about mingling of castes should arise. The disease showed signs of abating directly the people were got into huts, and the last case occurred in this village on the 4th December. The disinfection of the village was begun on the 31st October, and completed by the beginning of December, and may be briefly described as consisting of spraying the rooms with disinfectants, removing the furniture, white-washing the walls, and making large openings in the roofs of all the houses, to allow sunlight and air to penetrate freely; while in all infected houses the entire roof was removed, and the floor dug up to a depth of three inches. On the 6th December the Rawals, who had not had a case for a month among them, began to return to the village. Other castes followed, and all the inhabitants had returned to their houses by the 27th December. The cordon, however, was not removed till the 6th January 1898, in order to allow of 10 days' observation after every one had returned to the village; and the medical officer finally examined every person, and then declared the place free of plague. Some of the cases found in other villages seem to have been imported from Khatkar Kalán before the imposition of the cordon. The cases at Khatkar Khurd were found early, and the whole village was immediately evacuated, and escaped with only ten seizures.

Measures in Garhwal.—As soon as information was received by the authorities, the villagers who had not already left were removed and segregated, the houses were burnt and orders were issued that the site, which was water-logged and insanitary, should not be re-occupied. The neighbouring villages were thoroughly cleaned. These careful precautions were successful, and the infection did not spread. The direct pilgrim route through Okhimath was kept closed during the time that the danger of infection was apprehended.

Measures in Cutch.—The measures at first ordered, such as inspection of passengers arriving by sea, segregation and treatment, inspection of travellers leaving by land, were very late of being carried out, at least with any thoroughness; and when the European and native workers arrived to carry out operations in the style of Bombay, the epidemic had already reached a great height. An experience similar to that obtained in other parts of India was that plague in the village of Kathda was completely stopped by means of total evacuation; and it was noticed at Kathda, Mandvi, and elsewhere that people living out in the open in camps were particularly healthy.

Measures elsewhere.—The above were not the only places where measures against plague had to be adopted; but as it is quite impossible within the limits of this report to give a full account of the operations carried out in all the affected localities, the method has been followed of giving an account, in necessarily very condensed narrative, of what was actually done in very widely separated parts of India. The reader will obtain a general knowledge of how the plague was combated in India, and of the general ideas underlying the operations. Those who desire more detailed information must consult the official documents referred to. Nothing has been said of the occasional active opposition of the people, and very little of their almost constant passive opposition; because in general they are matters of common knowledge, and because in detail an account of them would occupy too much space. Throughout the paragraphs above and below regarding the progress of the disease and the measures taken against it the *ipsissima verba* of the reports consulted have been freely used without quotation marks, but sentences have been transposed and rearranged wherever the interests of condensation made it convenient.

The subject of preventive inoculation or vaccination has not been touched upon here, but it is discussed at page 164.

Railway Measures.—The importance of inspecting persons travelling by rail from the seat of the plague was recognised from the outset, and arrangements were made to inspect passengers and segregate the sick, as soon as it became clear that plague had taken a hold on Bombay, and showed a tendency to spread to other places. The Government of India was totally opposed to any interference with the ordinary avocations of persons who were not sick or suspicious, and refused also to exempt special classes from the operation of the rules. It decided that the principle governing the rules was that they should apply to all classes, but that detention should be enforced only in the case of such persons as were, in the exercise of the wide discretion which should be entrusted to the responsible officer, considered suspicious. The first arrangements were made by the co-operation of the civil with the railway authorities, who were directed to take action under sections 47 and 71 of the Railways Act (IX. of 1890). On the date that the Epidemic Diseases Act (III. of 1897) was passed the Government of India telegraphed to the different Local Governments and Administrations repeating its terms, and in doing this gave special directions with regard to the inspection of railway travellers. It was stated in the telegraphic circular that it was essential that the medical inspection of travellers in trains coming from the direction of infected districts should be complete, and that this could only be effected by the removal of the passengers from the train and their inspection by a medical officer on the platform ; also that this duty should ordinarily be performed by a commissioned medical officer. The Government suggested a series of inspection stations, which was afterwards altered in communication with the Local Governments. The inspection stations decided on are shown in the map opposite this page (not reproduced). At the principal inspection stations (marked with red on the map) a thorough examination was made of through passengers, or of passengers alighting at important centres of population, as the cases might be, and all suspicious persons were detained. At the subsidiary inspection stations (uncoloured) a less thorough examination was made, but there were arrangements for the detection and removal of sick persons, and for the treatment of plague cases in isolation hospitals. Although for the purpose of devising precautions to protect the rest of India it was necessary, when plague had become epidemic in nearly every district in the Bombay Presidency and Sind, to treat the whole of the province as infected, all places in the Presidency were by no means equally infected. Whilst some towns and villages were the scene of virulent epidemics, many others escaped altogether or suffered only slightly. To protect the uninfected against the infected localities, inspections were made of railway travellers at the time of starting from infected places, during the journey, and on arrival at destinations in the Presidency, similar to the inspections instituted for the protection of other provinces. By the Bombay rules the inspecting medical officers were empowered to examine all passengers arriving by, or intending to leave by, the train, and to detain persons suffering, or suspected to be suffering, from plague, in places appointed for the purpose. Hospital accommodation was provided for plague patients, and separate accommodation was furnished for suspected persons and for the medical staff. At minor inspection stations the officers appointed for the purpose were empowered to examine all persons alighting or intending to depart, and to detain at the appointed place all persons suffering, or suspected to be suffering, from plague. Surgeon-Major-General Warburton (Officiating Sanitary Commissioner with the Government of India), who made a tour of inspection on the railways at the end of March, recorded the following notes on the inspection stations at Kalyan and Bhusawal. At Kalyan twenty scheduled trains were examined daily. The morning report showed that there were 15 persons in the observation sheds, and 19 cases in the plague sheds. From the 13th February to the 29th March 301 persons had been detained. Of these 250 were suspects. Approximately 98 of the cases detained proved to be true cases of plague. Of these 63 had died, 16 had been discharged cured, and 19 remained under treatment. Dr. Warburton was present at the inspection of three trains, and found that the inspection was carefully and properly conducted. At Bhusawal four trains, with about 700 passengers, were examined daily. There were no trains to be examined during the night. The inspection of two evening trains at which Dr. Warburton was present were carefully performed. In the segregation camp there was accommodation for 20 plague cases and 5 suspects. There were 2 cases under observation, and 3 cases recovering from plague under treatment. Eleven other cases of plague, making 14 in all, had been detected and segregated, and of these 7 had died and 4 had been discharged on recovery. To carry out these numerous inspections of large bodies of travellers a considerable staff was of course required. At four stations in the North-Western Provinces and Oudh—Jhansi, Saharanpur, Ghaziabad, and Manikpur—European medical officers examined every passenger, the passengers being paraded for the purpose. Later on the inspection station at Manikpur was removed to Sutna. In addition to these

stations, alighting passengers were examined at the nine most important stations by hospital assistants, and the same procedure was carried out at thirty-one less important centres of population by vaccinators. Subsequently the number of these stations was increased, as experience indicated the necessity. Special arrangements existed at Haldwani, Hardwar, Roorkee, and Lhaksar. To ensure that such inspections were really efficiently carried out three travelling inspectors were appointed, who moved constantly all over the railway system of the provinces, and who submitted weekly reports to the Sanitary Commissioner. Passengers from infected areas were required to give their addresses to the special police staff at the stations, and information was then forwarded to the magistrate of the district to which the traveller was proceeding. Similar systems of surveillance of passengers were adopted in other provinces also. At Khana Junction in Bengal the observation encampment was divided into three portions—the plague hospital, the contact camp, and the suspect camp; and all the arrangements for detection and segregation were very thorough. Rules for the inspection of railway traffic were also issued in the Punjab, Madras, the Central Provinces, Hyderabad, Mysore, Rajputana, Central India, and Baluchistan. Where circumstances favoured such a course, passengers sometimes endeavoured to evade inspection, and various measures were adopted by the Local Governments to prevent their efforts from succeeding. For example, the Bengal Regulations of November 1897 contain the following rule:—"In the event of a traveller "from an infected area alighting at an intermediate station with the object of obtaining a "fresh ticket, so as to conceal the fact that he comes from an infected area, the railway "police will take down his name and the number of the fresh ticket issued, and will send "information down the line, so that he may, on alighting, be placed under observation." At a number of the principal inspection stations, both within and without the Bombay Presidency, special arrangements were made for the disinfection or destruction of all suspicious baggage. The following rule promulgated by the Government of the North-Western Provinces and Oudh is similar to those enforced in other provinces:—"If "necessary, the medical officer shall himself arrange for the disinfection or destruction of "clothes, &c. In cases where it is considered necessary that the clothes or bedding, &c., "of a traveller shall be burnt, the medical officer may, if the person is poor, or for other "sufficient reason, arrange for providing other articles in their place at the expense of "Government." On the 21st of April the Government of India issued a set of instructions for the disinfection of railway carriages, to take effect over the lines of all railway administrations. The instructions provided for two classes of cases: the disinfection of carriages in which cases of plague had been detected, and the disinfection of carriages coming from the infected area, though not containing cases of plague. To guard against the dangers of pilgrimages, measures such as those already described under the head of Hardwar, or total prohibition, were had recourse to. The Government of India issued several notifications under the Epidemic Diseases Act prohibiting the sale within the Bombay Presidency of tickets to travel by railway to the scene of different fairs held in various parts of India to pilgrims and other persons intending, or believed to be intending, to go on pilgrimage to those fairs. A number of similar orders were issued in the Bombay Presidency.

Road, River, and Frontier Measures.—Precautions were also adopted to prevent the spread of the plague by other means of communication. Some examples have already been given, as under the head of Hardwar. Observation posts were established, and authority was given to the plague officials to inspect and to detain. It was also sought to obtain the co-operation of villagers, and simple instructions were issued to them for the protection by themselves of their villages. Every precaution was taken to prevent the plague infection from crossing the frontier, and thence invading Baluchistan, Afghanistan, Persia, or Russia.

Maritime Measures.—The rules already issued by Local Governments under the Quarantine Act (I. of 1870) remained in force after the passing of the Epidemic Diseases Act, and were in some cases extended and modified. But first the Government of Bombay and then the Government of Madras issued fresh quarantine rules under the Epidemic Diseases Act, and the final rules framed in accordance with the Venice Sanitary Convention were all issued under that Act. On the 6th and 10th February respectively the Government of Bombay issued rules under the Epidemic Diseases Act for the inspection of vessels sailing from the ports of Bombay and Karachi; which practically came to this, that no vessel was permitted to depart until everyone on board had been examined, and any case suspected to be plague had been removed.

The International Conference assembled at Venice on the 16th February, and the Convention was signed on the 19th March. In a circular issued by the Government of India on the 1st of June the maritime local governments were directed to revise the

quarantine rules in accordance with the Venice Convention, and this they did by degrees at different dates. In the port of Bombay the total number of vessels of all kinds inspected was 72,808 against 570 in 1896, and the total number of persons inspected was 1,313,117 against 112,278. In all 169 cases of plague were detected, 79 in incoming vessels, 71 in outgoing vessels, and 19 in vessels lying in harbour. During the earlier part of the epidemic and up till the 6th February 1897, only vessels and persons bound for European and other quarantine ports were inspected. As an exodus of the plague-stricken population of the city had set in, Government decided to have an examination of every vessel and native craft, as well as of every crew and passenger, which left Bombay by sea for anywhere. These wholesale inspections commenced on the 6th February. The organisation for the medical inspection of all vessels and persons leaving Bombay by sea has been described in a special report by Surgeon-Lieutenant-Colonel MacCartie, published as an appendix to the "Account of Plague Administration "in the Bombay Presidency from September 1896 till May 1897." The object aimed at being the prevention of the spread of plague by sea to other Indian ports, to ports outside India, and above all to Europe, with its incalculable effects on Indian commerce, no measures were spared to obtain that end, and the most characteristic feature of the inspection became its extreme strictness and searching nature. Nor was the examination confined to the persons sailing on a vessel. The vessel itself was overhauled, and a high sanitary condition insisted on. This included the opening and thorough cleansing of lascars' boxes, which were often found to contain filthy clothes and rubbish, "quite "capable of supporting the plague microbes in comfort and affluence. In fact, it would "be impossible, humanly speaking, to devise a more stringent or exhaustive examination "for the prevention of the export of plague." All ship-commanders were, in addition, advised as to periodical inspections of their crew during the voyage, and of the advantage of frequent exposure to sun and wind of lascars' clothes and kit; whilst printed instructions were sent to shipping agents for issue to commanders of vessels without medical officers, describing the symptoms of plague, and the treatment to be adopted should the disease break out on their ships. It speaks well for the measures adopted by the Bombay Government that throughout the year 1897 only one ocean-going steamer was known to have plague on board after leaving Bombay. It is impossible to tell whether cases may not have got away across the harbour or down the Indian coast by sailing craft and small coasting steamer, notwithstanding the strict system of inspection for passengers by such vessels; but, at any rate, no such cases seem to have been reported. In all cases where plague developed among people who had been rejected from a ship, a telegram was sent to the next port of arrival with a warning that a case of plague had been removed from the vessel. During the year 3,322 persons were prevented from sailing in vessels. All persons having any suspicious signs or symptoms were rejected. Inspection of incoming vessels and passengers began in April, and 39,199 persons were segregated for periods varying from 2 to 10 days.

Emigration Measures.—On the 6th March 1897 a notification was issued by the Government of India prohibiting intending emigrants from the infected areas from leaving India.

The orders issued and measures taken with regard to the pilgrimage to Mecca are mentioned at page 163.

Measures anent susceptible articles.—The transmission as merchandise of rags and other articles likely to have come into contact with persons suffering from plague was forbidden. The exportation of grain was not forbidden, but very thorough precautions were taken. Special measures were adopted to obtain immediate information of plague cases occurring in grain godowns, or in the same building as grain godowns; and the grain was either, exceptionally, destroyed, or taken out and thoroughly exposed to the sun and the air, while the godown was carefully disinfected.

Conclusions.—The maritime measures adopted were very successful in preventing the transportation of the disease to Europe. The railway and maritime measures affecting India internally had a considerable, but a much smaller, degree of success; because they could be, and were, to a certain extent evaded, because it was impossible for roads to be as well watched as railways, and because the disease had already begun to spread before appropriate measures could be inaugurated. Where, as in the case of Hardwar, Khandraoni, Khatkar Kalan, Khatkar Khurd, Kathda, &c., a small town or village had to be dealt with, and information of the presence of the disease was early received, the measures adopted—complete evacuation of the village, thorough isolation of the sick and suspected, careful treatment of the sick—were eminently successful.

In the case of the native army also (*see* Section III., paragraph 58), where the affected people were under perfect discipline and the houses, &c., were the property of Government, similar measures were equally successful. But in large towns, such as Bombay, it was otherwise. Such a town could not be completely evacuated, many cases were neither reported nor detected, the persons who had come in contact with these cases were not isolated, and very many of the sick were not treated by a medical man. In small villages the people were more in the hands of the authorities, were more simple and docile, could have things explained to them and were able to see for themselves that no harm was being done to them, and that the result was quickly good. But in the large towns, for opposite reasons, the stringent plague measures caused vague feelings of panic and strong feelings of resentment, which led to concealment of cases and refusal of medical treatment in the town itself, and to flight of sick and infected or infection-carrying people to other localities. It has even been supposed that rats, carrying infection with them, were frightened away by the vigorous use of disinfectants and other disturbing agents. All the same, Hankin produces on page 726 of his article in Volume XII. of the *Annales de l' Institut Pasteur* evidence to show that the strenuous exertions of the Bombay Plague Committee may have been productive of good as far as the city itself was concerned. One of the great lessons to be learned from Indian experience is that simple isolation of the sick and of those who have been in contact with them is of no ultimate use. Nothing short of total evacuation is certainly effectual, total evacuation involving life in fresh open air at a considerable distance from the infected locality.

Fevers.

The total number of deaths registered under the heading " fevers " rose from 4,578,944 in 1896 to 5,026,725 in 1897, and the ratio per 1,000 of population from 21·05 to 23·12. The months of greatest mortality were November, October, and December. Each of the first six months of 1897 had fewer, and each of the last six months more, deaths than the corresponding month of 1896. The increase over the previous year was specially marked in November and October. The drought which had produced famine had reduced fever, but, when the copious and well-distributed monsoon rain of 1897 arrived, fever increased.

The greatest increases were in Coorg, the Central Provinces, Assam, and the North-Western Provinces and Oudh ; and the only decrease was in Bengal. The highest district maximum death-rate was 65 in the Central Provinces, and the lowest 15 in Burma. Why in the North-Western Provinces and Oudh the urban death-rate was in 1897, and usually is, higher than the rural, has not been explained. The same relation in Bombay in 1897, is, perhaps, due to the presence of plague in some towns.

The following table may be consulted not only for this, but also for the succeeding paragraphs dealing with fevers :—

Statement showing the deaths from Fevers registered in the different Provinces by Months during the year 1897.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.		Ratio of deaths per 1,000 of population.	
													1897.	1896.	1897.	1896.
Bengal	125,682	108,823	146,405	125,033	123,822	109,412	115,587	162,693	146,861	147,384	203,618	163,812	1,679,132	1,769,225	23·62	24·77
Assam	7,182	6,506	7,245	8,310	11,498	16,037	18,348	16,279	14,209	14,136	13,015	11,542	144,307	*101,347	28·74	20·18
North-Western Provinces and Oudh.	111,004	94,485	102,592	96,640	86,699	79,354	92,361	119,213	146,351	203,855	184,069	147,093	1,463,716	1,205,964	31·21	25·71
Punjab	25,131	19,289	21,360	21,347	25,724	25,657	22,857	23,919	37,231	65,191	76,382	58,738	422,826	393,535	20·57	19·15
Central Provinces ..	21,464	18,417	19,865	19,356	24,245	31,308	35,475	50,655	53,522	50,367	38,325	26,336	389,335	280,760	40·98	29·55
Berar	3,005	2,648	2,989	3,632	4,752	4,557	5,337	8,740	10,461	9,153	5,785	4,552	65,611	61,931	23·00	21·78
Lower Burma	4,489	3,531	3,294	3,457	3,381	3,353	4,912	4,940	4,605	4,566	4,825	6,399	51,752	51,521	11·46	11·41
Madras Presidency ..	22,389	17,868	18,883	18,493	21,137	23,036	26,962	26,771	27,323	30,368	27,910	31,152	292,292	280,769	8·97	7·97
Bombay Presidency ..	37,462	36,087	37,363	34,647	31,029	31,018	36,752	44,547	42,014	43,449	43,625	34,603	452,596	412,229	24·05	21·90
Ajmere-Merwara ..	730	589	644	702	816	690	505	925	1,328	1,598	1,275	1,081	10,883	9,403	20·07	17·34
Coorg	397	330	421	442	664	832	996	857	545	611	552	535	7,182	3,552	41·50	20·53
Mysore	3,444	2,651	2,919	2,958	2,811	3,108	4,003	3,795	3,755	4,371	6,175	7,103	47,093	37,708	9·72	7·79
Total ..	362,379	311,224	363,980	335,017	336,578	328,362	364,095	463,334	488,205	575,049	605,556	492,946	5,026,725	4,578,944	23·12	21·05

* Includes 15,637 deaths from *Kala Azar*.

Sale of Quinine at Post Offices.—In Bengal there was a decrease of 3,962 parcels of quinine sold, each parcel containing 102 five-grain pice packets. The Sanitary Commissioner considers this to be probably due to the diminished prevalence of fever; and that the sale of the drug on an extensive scale is only a question of time, the gradual increase in the number of post offices in the interior of the province, as well as the increasing knowledge on the part of the people that this cheap and efficacious remedy can be had within easy reach of their homes, being certain gradually to have the effect of increasing the distribution of quinine among the people in this way.

In Assam, excluding 100 packages supplied to the Manipur State, and 319 distributed to vaccinators, 2,181 packages were sold against 1,059 in 1896. The increase in the amount sold through post offices in the Surma Valley, in which malarial fevers were very prevalent, was considerable. Packets of quinine were advertised for sale at all post offices in the Surma and Brahmaputra Valleys, and in the Khasi and Jaintia Hills during the year; and in the beginning of the vaccinating season two packets of quinine were given to each district vaccinator, as a permanent advance, with instructions to sell as many packets as possible in the villages visited by them in the ordinary course of their duties. In the Khasi and Jaintia Hills packages were also supplied to the missionaries, who take much interest in the work.

The sale of quinine was extended to all districts of the North-Western Provinces and Oudh. But the working of the scheme in 1897 was disturbed by the necessity of largely distributing this remedy *gratis* during the severe malarial fever which prevailed in the autumn. This liberal and gratuitous distribution of quinine to the poorer classes was very useful in mitigating the effects of the widespread malaria.

No statistics of the sale of quinine in the Punjab are given, but it is mentioned that the drug was freely and gratuitously distributed. Lala Mul Chand, Officiating Civil Surgeon of Karnal, says:—

"Personally I see there is no necessity for free distribution any longer, as the people have now "become fully alive to the benefits of the prophylactic; and its purchase through the post office and "other agencies will be enhanced, if the gratis distribution be put a stop to. Of course the gratis "distribution through the district dispensaries should be continued as heretofore."

The Central Provinces, Berar, and Madras do not appear to have furnished particulars of quinine sales.

In Coorg, during the year, 807 packets were sold at the various post offices, a very encouraging increase. The sale of quinine at the rural post offices is very much appreciated by the public; and the Sanitary Commissioner regrets that it was found necessary by the Government of India to increase the price of the powders at present, as he fears it may deter the poorer classes from buying.

No sale-statistics come from Bombay or Burma; but the Sanitary Commissioner of the latter province says that the Government scheme is in its infancy, and has not yet found general favour with the people.

Bengal.—The number of deaths attributed to fevers in Bengal in 1897 was 1,679,132, as compared with 1,760,225 in 1896; and the death-rate was 23·62 against 24·77 for the preceding year, 23·32 for the five-year period, and 19·81 for the decennium 1887–96. The smaller mortality as compared with the previous year was chiefly due to the exceptional healthiness of the earlier months, January to April, the result, no doubt, of the early cessation of the rains during the previous season. The excessive mortality from fevers in the Hazaribagh district was attributed to the debilitated condition of the people from famine; and the Civil Surgeon of Faridpur calls attention to a factor in the production or encouragement of malaria that is every year gaining ground, the steeping of jute in every available pool of stagnant water. The heaviest mortality took place in the months of November, December, and August, and the lightest in February, June, and May. The first seven months and the last month of 1897 had decidedly lower, the other months decidedly higher, mortalities than the corresponding months of 1896. Two districts, Pabna and Hazaribagh, had ratios over 35 per 1,000; four, Rangpur, Dinajpur, Jalpaiguri, and Chittagong, ratios over 30; fourteen, ratios not less than 25; eleven, ratios not less than 20; ten, ratios not less than 15; four, ratios not less than 10; one, a ratio not less than 5. The rural mortality was 23·88, the urban, as usual lower, 18·60. The extremes of town mortalities were 45·12 at Bhabua, followed by four ratios over 35, and 5·07 at Jhalukati.

The 154 admissions, against 211, of the European seamen of the port of Calcutta were made up by 7 enteric fever, 91 malarial fever, and 56 simple fever. The only death was

from enteric fever. There were 47 deaths, all out of hospital except 3, among the native floating population, yielding a ratio of 1·83 per 1,000 against 1·20 in the preceding year.

Assam.—Under the heading "fevers," in which the reporting agents are apt to include all diseases wherein rise of temperature is a prominent symptom, there were, including *kala azar*, 144,307 deaths registered in Assam in 1897; and the death-rate, which was 20·18 per 1,000 in 1896, rose in 1897 to 28·74, or 10·69 per 1,000 in excess of the mean of the previous five years. Most deaths occurred in July, August, and June, and fewest in February, January, and March. The first three months of the year showed a decrease as compared with the corresponding months of 1896, all the other months an increase, which in the case of July, August, and September amounted to a doubling. Very extensive flooding, says the Sanitary Commissioner, occurred in the Goalpara and Kamrup districts, owing to the raising of the river beds by the earthquake, and it was feared that these excessive floods would increase the mortality from malarial fevers. On the whole, however, there was no increase in those two districts, and the greatest increase in the fever mortality occurred in the Cachar district, in which the disturbances produced by the earthquake were comparatively small. The highest district death-rates were those of Nowgong (41·77), where *kala azar* is very prevalent, and of Cachar (35·30), from which none was returned. Besides these, three districts had ratios not lower than 30; one a ratio not lower than 20, and three ratios not lower than 10. The rural death-rate was 28·82, or excluding the hill district, 26·18. The mean urban mortality was 24·86; and the extremes were 65·69 at Karimganj and 2·29 at Jowai.

Regarding the distribution of *kala azar* the provincial Sanitary Commissioner writes:—

"During the year 18,612 *kala azar* deaths were reported, as against 15,637 in 1896. The mortality "from this cause in the Goalpara district continues to decrease; but in the other three districts in "which the disease is prevalent, Kamrup, Darrang, and Newgong, the recorded mortality from "*kala azar* was considerably greater than it was in the previous year. In Kamrup the increase was "inconsiderable, but in Darrang and Nowgong 1,126 and 1,424 more *kala azar* deaths, respectively, "were reported than in 1896. In the Nowgong district 12,012 deaths from *kala azar* and 2,364 "from 'other fevers' were reported as against 10,588 deaths from *kala azar* and 1,905 from 'other "fevers' in 1896. As noted in last year's report, the number of deaths registered under 'other "fevers' in the Nowgong district is so much smaller than the number recorded under this heading "before *kala azar* made its appearance, that, in all probability, many deaths which in former years "would have been registered under ordinary fevers were returned in 1897 as *kala azar* . . . . . The "greatest increase in the mortality from *kala azar*, as compared with 1896, in the Kamrup district "occurred in the Barpeta town and rural circles and in the Nalbari rural circle. In the Darrang "district more deaths were registered from this cause in all registration circles than in the previous "year, and the disease appears to have gained a footing in every portion of the district. The *kala azar* "death-rate was smaller than it was in 1896 in the Samaguri registration circle, but in the rest of the "Nowgong district the mortality registered from this cause was greater than it was in the previous "year. The months of greatest prevalence of *kala azar* were June, May, and October, and the "registered mortality was smallest in February and January. In 1896 the months of maximum "prevalence of the disease were May, June, and April, and the months of minimum prevalence were "February and January. In the circles in which *kala azar* was prevalent the greatest number of "deaths was registered under 'other fevers' in May, June, and April, and the smallest number in "September and February. In 1896 the months of maximum mortality from 'other fevers' were "June, May, and July, and the mortality was smallest in April, September, and October."

North-Western Provinces and Oudh.—The number of deaths ascribed to fevers in 1897 was 1,463,716, against 1,205,964 in 1896. The death-rate was 31·21 as opposed to 25·71 in the previous year, and to the mean ratio of 24·93 for the quinquennial period antecedent to the year under review. The heaviest mortalities occurred in October, November, and December, and the lightest in June, May, and July. The mortality in each of the first six months was lower, that in each of the last six months higher, than the mortality of the corresponding months of 1896. I am inclined, says the Sanitary Commissioner, to consider that the decline in the spring was due to more food being then available, and to attribute the premature incidence of mortality in July to the fact that persons in a weakened condition succumbed to even the weaker form of the malarial poison likely to be generated so early in the rains. There is no doubt but that later in the year malarial fever was of a severe type . . . . . It is unsafe to definitely say more than that malarial fever this year was of a severe type, and that the people generally were, from a reduced condition of health, less able than usual to withstand it. Four of the districts, Bareilly, Hamirpur, Jalaun, and Agra had death ratios over 45 per 1,000; three, Pilibhit, Hardoi, and Lucknow, ratios over 40; seven, ratios not under 35; sixteen, ratios not under 30; nine, ratios not under 25; six, ratios not under 20; and three, ratios not under 15. The

rural mortality was 30·95. On the other hand, the urban death-rate was 34·61, higher than the rural, a usual provincial peculiarity never yet accounted for in the local report. The extreme town mortalities were 88·17 at Pilibhit and 14·83 at Nawabganj.

Punjab.—There was an increase in the fever mortality in the Punjab, the number of deaths having risen from 393,535 in 1896 to 422,826, and the ratio per 1,000 of population from 19·15 to 20·57. The ratio for the preceding quinquennium was 23·41. The months of greatest mortality were October, November, and December; and those of lowest mortality, February, April, and March. The first eight months had diminished mortality as compared with the corresponding months of 1896; the last four months increased mortality, the increase amounting to doubling in October, November, and December. The highest district death-rates were those of Dera Ismail Khan (40·49) and Muzaffargarh (37·99). Besides these, three districts had ratios not less than 30 per 1,000, four not less than 25, six not less than 20, eight not less than 15, seven not less than 10, and one a ratio not less than 5. The rural death-rate was 20·80; the urban, as usual, lower than the rural, 18·43; and the urban extremes, 72·61 at Khairpur, and 5·35 at Abbottabad.

Central Provinces.—In the Central Provinces the deaths from fevers numbered 389,335, or 108,575 more than in 1896; and the mortality ratio per 1,000 of population was 40·98, against 29·55 for 1896 and 23·13 for the quinquennium. The months of greatest mortality were September, August, and October, and those of least mortality, February, April, and March. Every month of the year, except February, March, and April, had more deaths than the corresponding month of 1896, about double in the case of June and July. The term "fevers," as here recorded, says the Sanitary Commissioner, is very indefinite as regards the cause of death; and much of the general mortality from a great variety of causes is included under this head. In fact, owing to the ignorance of the reporting agency, the term is frequently used to indicate the cause of death generally, and may be, and is, applied to diseases with no relation to, or connected with, specific or malarial fevers. While the term has general application as to the cause of death, the existence of a very fatal type of malarial fever in the autumn of the year in certain areas was undoubted. In some districts the mortality from actual intermittent fever was great, and in others slight . . . . . There was no evidence to indicate that, and civil surgeons were instructed to be carefully observant whether the fever prevailing in the Central Provinces was of a contagious, relapsing, or typhous type. The highest district ratios were those of Bilaspur (66·34), Balaghat (61·37), and Saugor (60·77). Besides these, one district had a ratio not less than 50 per 1,000, three districts ratios not less than 45, three not less than 40, two not less than 35, two not less than 30, four not less than 25, one not less than 20, and one not less than 5. The rural mortality was 42·08, as usual much higher than the urban, which was 29·16. The urban extremes were 136·91 at Mungeli, a town of 4,755 inhabitants in the Bilaspur district, and 7·48 at Sambalpur. Four other towns, out of the 72, had ratios over 60 per 1,000.

Berar.—The number of deaths from fevers in Berar rose to 65,611 in 1897 from 61,931 in 1896. The ratio per 1,000 of population was 23·00, against 21·78 in 1896 and against 20·0 for the quinquennium. The heaviest mortality occurred in the months of September, October, and August, and the lightest in the months of February, March, and January. The first five months of the year had fewer deaths than the corresponding months of 1896, only about half as many in the case of the first four months; while the other months had more deaths, the increase in September amounting to doubling. The feeble health and depraved condition of body of the starving poor, says the Sanitary Commissioner, rendered them peculiarly liable to succumb to any prevailing disease and to rapidly become affected by those malarial influences which usually follow in the train of the south-west monsoon. The experience of the famine year 1878 was the same. The highest district death-rates were those of Wun (30·6) and Amraoti (25·5). Two other districts had ratios over 20 per 1,000; and two, ratios over 15. The rural death-rate was 23·1, higher than the urban, which was 22·4. The extreme town mortalities were 54·1 at Wadegaon, and 4·7 at Karajgaon.

Madras.—The number of deaths recorded in Madras as due to fevers was 292,292, or 31,523 more than in the previous year; while the ratio per 1,000 of population was 8·97, against 7·97 in 1896 and against 8·1 for the quinquennium. The months of greatest

mortality were December, October, and November, and the months of least mortality February, April, and March. Each of the first five months had fewer, each of the remaining seven months more, deaths than the corresponding months of 1896. The comparative freedom in the early part of the year, says the Sanitary Commissioner, must be ascribed to the diminished soil moisture proving inimical to the propagation of the malarial germ, in consequence of the failure of the north-east monsoon of the previous year; this was followed, on access of moisture with the south-west monsoon, in the presence of a population rendered susceptible to malaria owing to diminished food-supply, by a mortality greater than normal under this head. The highest district death-rate was that of Vizagapatam (23·8); and four districts had ratios not under 15 per 1,000; four, ratios not under 10; nine, ratios not under 5; and four, ratios under 5. The rural mortality was 9·0, the urban as usual less, 8·0. The extreme town ratios were 29·7 at Kampli and 0·1 at Rajahpalaiyam; while the town of Kalahasti, with a population of 11,715, appears to have returned no fever mortality. In the case of Kurnool town, where the ratio increased from 13·5 in 1896 to 21·7 in 1897, the Sanitary Commissioner is of opinion that the probability is that the disturbance of the soil during the excavations for the water works throughout the town had much to do with the result.

Coorg.—In Coorg there were 7,182 deaths ascribed to fevers, an increase of 3,630; and the ratio per 1,000 of population was 41·50, against the 20·53 of 1896 and the 20·75 of the quinquennium. The fever mortality ratio was nearly 83 per cent. of the death-rate from all causes. The rural mortality was 42·69, and the urban as usual lower, 29·46. The highest town mortality was 39·13 at Virajendrapet, and the lowest 21·75 at Mercara. The months of maximum mortality were July, August, and June, and the months of minimum mortality, February, January, and March. Each month of the year had more deaths than the corresponding month of 1896, the increase in each month from April to November, inclusive, amounting to doubling or more than doubling.

Bombay.—The total of deaths from fevers registered in Bombay was 452,596, or 40,367 more than in 1896; and is the highest recorded in, at least, thirteen years. The ratio per 1,000 of population was 24·05, against the 21·90 of 1896 and the 21·56 of the quinquennium. The increase was, at least partly, due to the prevalence of plague. The heaviest mortality characterised the months of August, November, and October, and the lightest June, May, and December. Each of the first five months of the year had fewer, and each of the remaining months more, deaths than the corresponding month of 1896. Although famine was present, yet owing to the scanty rainfall in the latter part of the monsoon of 1896, the deaths from fever would, in all districts, except the southern and western registration districts, have been, but for plague, about equal to the numbers reported in 1896. The highest district death-rate was that of the City of Bombay (33·40); three other districts had ratios over 30 per 1,000; seven, ratios not less than 25; five, ratios not less than 20; seven, ratios not less than 15; and one, a ratio not less than 10. The rural mortality was 23·24, the urban 29·86. The unusual fact that the urban mortality was higher than the rural is probably due to the presence of plague in some towns. The town extremes were 74·88 at Kirkee and 5·67 at Deolali Cantonment.

Lower Burma.—The number of deaths registered in Lower Burma under the heading of fevers in 1897 was 51,752, as compared with 51,521 in the previous year; and the death-rate was 11·46, against the 11·41 of 1896 and the 10·75 of the quinquennium. The months of greatest mortality were December, August, and July, and those of least mortality, March, June, and May. The months of January, July, October, November, and December had more, the other months fewer, deaths than the corresponding months of 1896. That the mortality of the second half of the year is greater than that of the first is no doubt due, says the Sanitary Commissioner, to the rise of the ground water which takes place during the rains and continues for some time after they have ceased. The highest district ratio was that of Sandoway (19·10); two other districts had ratios not under 15 per 1,000; eight, ratios not under 10; and seven, ratios not under 5. The rural death-rate was 12·05, and the urban as usual less, 7·53. The Sanitary Commissioner considers that the small ratio of urban mortality is to be explained by the fact that the drainage and sanitary requirements of the towns are better attended to than is the case in the rural areas, and by the diagnosis being to some extent more trustworthy. The extreme urban ratios were 17·48 at Shwegyin and 2·25 at Shwedaung.

Dysentery and Diarrhœa.

The number of deaths attributed to dysentery and diarrhœa throughout the registration areas of India during 1897 was 403,833, an increase of 163,644 ; and the ratio per 1,000 of population was 1·86 against 1·10 in the previous year. The months of greatest mortality were August, September, and October, and those of least mortality February, January, and March. Every month of the year had more deaths than the corresponding month of 1896 ; double in September and October. The highest provincial death-rates were those of Berar and of the Central Provinces, and the lowest that of Bengal. Every province showed an increase of ratio, the increases of the Central Provinces, Berar, and Bombay being greatest. The highest maximum district death-rates were in the Central Provinces and Berar, and the lowest maximum district death rate in the Punjab. The explanations given for the increase of bowel affections are, generally, that abundant rain after drought favoured the active causes, while the lowering of bodily strength by famine produced predisposition. In all provinces the urban mortality exceeded the rural.

The following statement illustrates not only what has just been written, but also the succeeding paragraphs upon bowel complaints in the different provinces :—

Statement showing the Deaths from Dysentery and Diarrhœa registered in the different Provinces by Months during the year 1897.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.		Ratio of deaths per 1,000 of population.	
													1897.	1896.	1897.	1896.
Bengal	3,085	2,870	3,921	3,880	4,091	3,749	4,606	7,451	6,387	4,362	5,133	4,287	53,822	47,935	0·75	0·67
Assam	1,239	1,157	1,341	1,446	2,064	2,012	2,273	2,249	2,264	2,425	2,528	2,138	23,136	16,004	4·61	3·19
North-Western Provinces and Oudh.	4,012	4,003	6,691	5,653	4,196	4,106	4,614	6,204	5,968	5,642	4,388	3,345	58,822	40,858	1·25	0·87
Punjab	860	560	564	862	1,100	953	930	1,460	1,973	2,514	2,181	1,894	15,851	13,886	0·77	0·68
Central Provinces ..	3,291	4,621	4,625	4,138	5,651	7,169	8,638	12,351	12,676	9,411	5,393	3,128	81,092	29,882	8·53	3·15
Berar	690	573	667	1,071	1,436	1,398	2,657	6,282	6,755	4,569	2,117	1,334	29,549	17,722	10·36	6·23
Lower Burma	484	615	620	723	745	806	1,542	1,094	706	485	445	528	8,793	7,777	1·95	1·72
Madras Presidency ..	2,834	2,080	1,997	1,911	2,126	2,710	4,404	5,000	4,772	4,317	3,416	3,149	38,716	24,802	1·19	0·76
Bombay Presidency ..	2,943	2,859	3,814	4,910	5,845	6,280	10,637	13,507	12,002	10,225	7,171	5,773	85,966	36,046	4·57	1·92
Ajmere-Merwara ..	28	18	15	22	23	19	20	68	79	50	44	53	439	379	0·81	0·70
Coorg	25	15	20	30	65	81	80	73	67	40	22	20	538	323	3·11	1·87
Mysore	354	279	375	350	466	581	817	899	887	736	661	704	7,109	4,575	1·47	0·94
Total	19,845	19,650	24,650	24,996	27,808	29,864	41,218	56,638	54,536	44,776	33,499	26,353	403,833	240,189	1·86	1·10

Bengal.—The number of deaths registered from dysentery and diarrhœa in Bengal in 1897 was 53,822, or 5,887 more than in the preceding year ; and the ratio per 1,000 of population was 0·75, against the 0·67 of 1896 and the 0·69 of the quinquennium. The months of greatest mortality were August, September, and November, and those of least mortality, February, January, and June. Each of the first six months had fewer, and each of the last six more, deaths than the corresponding month of 1896. The increase was most marked in August and September. The returns are not regarded as quite correct, and it is believed that many cases are returned as "fevers." The somewhat larger mortality of the year, says the Sanitary Commissioner, was almost solely due to the fact that on account of the prevailing scarcity the poorer classes of the people were obliged to live on herbs, roots, leaves of trees, and other unsuitable and unwholesome food. This, as a matter of course, materially lowered their health status, and eventually brought on this disease in a serious form. Polluted water-supply also added to the virulence of the disease in many places. The highest district ratios were those of Lohardaga (4·96), Calcutta (4·72), and Puri (4·08). Besides those, two districts had ratios not less than 3 per 1,000 ; three, ratios not less than 2 ; four, ratios not less than 1 ; eleven, ratios not less than 0·5 ; twenty-one, ratios not less than 0·05 ; and two, ratios less than 0·05. The rural death-rate was 0·61, the urban, 3·50. That the urban mortality is usually the greater seems to the Sanitary Commissioner to be chiefly due to overcrowding and its

attendant evils, which are more intense in towns than in the open country, and also to the greater probability of the disease being correctly diagnosed and reported in towns. The urban extreme ratios were 13·74 at Kotrung and 0·08 at Pirojpur.

In the port of Calcutta there were 52 admissions, but no deaths, among the European seamen ; while in the native floating population there were 13 deaths, 9 of them out of hospital, or 0·50 per 1,000 of strength.

Assam.—There were 23,136 deaths registered as due to dysentery and diarrhœa in Assam in 1897, an increase of 7,132 ; and the death-rate was 4·61 per 1,000, against 3·19 the death-rate of the previous year, and against 3·06 the quinquennial mean death-rate. The months of greatest mortality were November, October, and July, and those of least mortality, February, January, and March. Each month of 1897, except January, had more deaths than the corresponding month of 1896. It is supposed that a good many cases of cholera were returned under this head in the Sibsagar district, and that the large amount of bowel complaints in the Surma Valley was due to the excessive prevalence there of malarial fevers, along with which these bowel affections frequently appear as complications. The heavy mortality from dysentery and diarrhœa in the Khasi and Jaintia Hills is stated to have been the result of the exposure to which the people were subjected after the earthquake. The highest district ratio was that of Lakhimpur (11·66), and the lowest that of Goalpara (0·79). Excluding those, three districts had ratios not under 4 per 1,000 ; and four, ratios not under 1. The rural mortality was 4·46 and the urban 11·47. The extreme town mortalities were 33·47 at Golaghat and 0·83 at Jowai.

North-Western Provinces and Oudh.—The total number of deaths ascribed to dysentery and diarrhœa in 1897 was 58,822, an increase of 17,964 ; and the death-rate was 1·25, against the 0·87 of 1896 and the 0·97 of the quinquennium. The months of heaviest mortality were March, August, and September, and those of lightest mortality December, February, and January. Each month of 1897, except December, had more deaths than the corresponding month of 1896 ; and in February, March, and April the increase amounted to doubling or more. The highest district death-rates were those of Garhwal (5·91), Banda (4·69), Fatehpur (4·39), and Jhansi (4·36). Excepting for the hill tracts, says the Sanitary Commission, which always show large ratios for these diseases, the explanation no doubt lies in the exposure necessarily attendant on the congregation of large bodies of workers on relief works. Besides those, five districts had ratios not under 3 per 1,000 ; three, ratios not under 2 ; eleven, ratios not under 1 ; six, ratios not under 0·5 ; nineteen, ratios not under 0·05. The rural death-rate was 1·05, the urban 3·99. The extreme town ratios were 46·00 at Hardoi and 0·03 at Pilibhit, but five towns returned no deaths. Fatehpur, Unao, Rae Bareli, Sandila, Kunch, and Kashipur, in order, had also high ratios. Kashipur, says the Sanitary Commissioner, is notoriously unhealthy ; in other cases the explanation probably lies in the existence of poor-houses.

Punjab.—There were 15,851 deaths attributed to these causes in the Punjab, an increase of 1,965 ; and the ratio per 1,000 of the population was 0·77, against 0·68 in the previous year and 0·83 the quinquennial mean. The heaviest mortalities occurred in the months of October, November, and September, and the lightest in February, March, and January. June and the last four months of the year had more deaths than the corresponding months of 1896. The increase was greatest in October, November, and December. The highest district death-rates were those of Hissar (2·02) and Simla (2·01) ; six districts had ratios not less than 1 per 1,000 ; thirteen, ratios not less than 0·5 ; and ten, ratios not less than 0·05. The rural mortality was 0·58, and the urban as usual greater, 2·52. Exclusive of three towns which returned no deaths, the urban extremes were 12·74 at Balabgarh and 0·13 at Patti.

Central Provinces.—The number of deaths registered under this heading in the Central Provinces was 81,092, an increase of 51,210 ; and the death-rate per 1,000 of population was 8·53, against the 3·15 of 1896 and the 2·02 of the quinquennium. The months of greatest mortality were September, August, and October, and those of least mortality, December, January, and April. Each month of 1897 saw the occurrence of more deaths than the corresponding month of 1896 ; and only in December was the increase less than twice or thrice. The exceptionally high death-rate from such causes, says the Sanitary Commissioner, clearly indicates the severity and extent of the late famine, and the distress and suffering which affected a large proportion of the population. Dysentery and diarrhœa are the specially fatal diseases of the aborigines, who, living from hand to mouth on jungle foods, suffer severely from bowel disorders, particularly in times of scarcity, and rapidly

succumb to such complaints. The highest district death-rates were those of Merwara (24·14) and of Mandla (23·12) ; one district had a ratio not under 15 per 1,000 ; five districts, ratios not under 10 ; six, ratios not under 5 ; and six, ratios not under 1. The rural death-rate was 6·99, the urban 25·16. The extreme town mortalities were 188·59 at Burha and 0·16 at Kamptee. Eight other towns out of the seventy-two had ratios over 100, two of them, Mungeli and Mandla, over 160.

Berar.—The total number of deaths registered as due to dysentery and diarrhœa in Berar in 1897 was 29,549, an increase of 11,827 ; and the death-rate was 10·36 per 1,000, as compared with 6·23 in the previous year, and with 5·8 the mean death-rate of the previous five years. The heaviest mortalities occurred in the months of September, August, and October, and the lightest in the months of February, March, and January. Each of the first five months of 1897 had fewer, and each of the other months more, deaths than the corresponding month of 1896. The increase amounted to more than doubling in August and November, and to more than trebling in September and October. The famine distress in itself, says the Sanitary Commissioner, is sufficient to account for the great increase of mortality under this head, as diarrhœa and dysentery are the usual ending in chronic starvation. It was noted at poor-houses and other centres of medical relief that as soon as the monsoon rains set in bowel complaints became rife amongst the destitute poor, a large proportion of the mortality being due to dysentery and diarrhœa. The highest district death-rate was that of Ellichpur (16·4) ; two other districts had ratios not below 10 per 1,000 ; two, ratios not below 5 ; and one a ratio below 5. The rural mortality was 10·2 ; the urban mortality 11·3 ; and the urban extremes were 27·4 at Pusad and 0·3 at Wadegaon. Seven other towns out of the 38 had ratios over 20 per 1,000.

Madras.—The total number of deaths registered under this heading in Madras in 1897 was 38,716, an increase of 13,914 ; and the death-rate was 1·19 compared with the 0·76 of 1896 and the 0·8 of the quinquenninm. The months of greatest mortality were August, September, and July, and those of least mortality, April, March, and February. Every month except December had more deaths than the corresponding month of 1896 ; and the increase in July and August nearly amounted to doubling. Seven of the districts which contributed to the excess were "formally recognised" as suffering from famine. The highest district mortalities were those of Madras (4·5), Malabar (3·3), and South Canara (3·2) ; three other districts had ratios not under 2 per 1,000 ; four, ratios not under 1 ; nine, ratios not under 0·5 ; and three, ratios not under 0·05. The rural death-rate was 1·0 ; the urban, as usual higher, 3·5. The town ratio-extremes were 8·5 at Bimlipatam, and 0·1 at several towns ; but 12 towns returned no deaths from dysentery and diarrhœa. In view of the continued presence of diarrhœa and dysentery in Coonoor, from which the death-rate in 1897 was 7·2, the Sanitary Commissioner urges upon the municipality the adoption of a sound scheme of water-supply now before it, "if it does not "wish the fame of Coonoor as a sanitarium to pass away from it for ever."

Coorg.—During 1897 the number of deaths under this heading in Coorg rose to 538 from 323 in the preceding year. The ratio of 1897 was 3·11, that of 1896, 1·87 ; and that of the quinquennium, 1·56. In June, July, and August the deaths were most, and in February, March, and December least, numerous. Each month of 1897 had more deaths than the corresponding month of 1896, double in March, nearly double in February, June, and July, and more than double in September and October. The rural mortality was 1·89, the urban, 15·54, The town extremes were 36·43 at Virajendrapet and 0·66 at Somvarpet.

Bombay.—During 1897 the number of deaths from dysentery and diarrhœa in Bombay was 85,966, an increase of 49,920 ; and the ratio per 1,000 of population was 4·57, against the 1·92 of 1896 and the 1·85 of the quinquennium. The months of greatest mortality were August, September, and July, and those of least mortality, February, January, and March. Every month of 1897 had more deaths than the corresponding month of 1896 ; and after March the increase in most cases amounted to more than double or treble. There is no doubt, says the Sanitary Commissioner, that the large rise in mortality from dysentery and diarrhœa is due to famine. In areas where the famine most prevailed the mortality is found to be the highest, and in the areas upon the fringe of the famine the death-rates are also high. The highest district death-rate was that of Sholapur (12·22) ; eight other districts had ratios not less than 5 per 1,000 ; four, ratios not less than 1 ; two, ratios not less than 0·5 ; and nine, ratios not less than 0·05. The rural death-rate was

4·48 ; the urban, as usual higher, 5·17. The urban extremes, excluding three towns that returned no deaths from the diseases in question, were 23·14 at Athni and 0·12 at Dholka.

Lower Burma.—In Lower Burma the number of deaths registered from dysentery and diarrhœa was 8,793, or 1,016 more than the number of the previous year. The ratio per 1,000 of population was 1·95 for 1897, 1·72 for 1896, and 1·59 for the quinquennium. Deaths were most numerous in July, August, and June, and least so in November, January, and October. In each month of 1897, except January, June, September, October, and November, there were more deaths than in the corresponding month of 1896, double in April, and not far from the same in February and March. Four districts had ratios not under 3 per 1,000, Toungoo having the highest ; five, ratios not under 2 ; seven, ratios not under 1 ; and two, ratios under 0·5. The rural mortality was 1·83 ; the urban, as usual greater, 2·71. Excluding three towns that returned no deaths from bowel complaints, the urban extremes were 8·43 at Ramree and 0·16 at Shwedaung.

Injuries.

The deaths recorded under "injuries" during 1897 numbered 115,947 deaths, or 23,416 more than in the preceding year. Most of the provinces participated in the increase. The ratio of mortality ranged from 0·79 in the Central Provinces to 0·22 in Mysore. The months that saw most deaths from injury were August and November ; and the maximum usually falls in the third quarter of the year.

Statement showing details of Deaths from Injuries registered in the different Provinces during the year 1897.

Province.	Population under registration.	Details of Deaths from Injuries.				Total.
		Suicide.	Wounding.	Accident.	Snake-bite or killed by wild beasts.	
Bengal	71,069,617	3,828	2,033	24,274	12,461	42,596
Assam	5,021,084	119	147	2,081	303	2,650
N.-W. Provinces and Oudh	46,904,791	3,834	1,906	2,298	5,512	33,550
Punjab	20,553,982	355	685	5,024	1,201	7.265
Central Provinces	9,501,401	1,424	733	4,020	1,373	7,550
Berar...	2,852,825	271	47	873	144	1,335
Lower Burma	4,514,773	80	180	305	545	1,110
Madras Presidency... ...	32,598,301	2,173	7,150		260	11,583
Bombay Presidency ...	18,820,346	652	636	4,301	1,318	6,907
Ajmere-Merwara	542,358	8	33	165	50	256
Coorg...	173,055	8	13	36	3	60
Mysore	4,843,523	112	96	729	148	1,085
Total	217,396,056	12,864	57,765		25,318	115,947

All Other Causes.

The number of deaths recorded under "All Other Causes" was 1,476,672 against 1,358,260 ; and the ratio per 1,000 of population, 6·79 against 6·24. Only in Bengal, Madras, and the Punjab was there a decrease of ratio. The greatest number of cases under this heading was returned in August.

Vaccination.

The total number of vaccinations performed among the civil populations in all the provinces of India, during 1897–98, was 7,829,983, as compared with 8,019,836 in 1896–97. The decrease in the number of operations was confined to Bombay, the North-Western Provinces and Oudh, the Punjab and the Central Provinces, where the working of the department was hindered and embarrassed by the conditions arising from the presence of famine or plague or both. In the remaining provinces there was a marked increase in

the number of operations as compared with the previous year. Of the total number of operations performed, 7,209,794 were primary, of which 6,771,664, or 93·92 per cent., were successful ; and 620,189 were cases of re-vaccination, of which 399,823, or 64·47 per cent., succeeded.

Excepting in Madras, Bengal, Assam and Burma, the amount of protection afforded to the infant population was less than in 1896–97. The total number of children under one year of age successfully vaccinated was 2,815,592, against 2,903,167 in the preceding year ; the percentage protected, estimated on a hypothetical birth-rate of 40 per 1,000 of the census population, ranging from 63·4 in Berar to 17·8 in Bengal and 13·10 in Coorg. The number of children, between one year of age and six years, who were successfully vaccinated was 3,172,881, against 3,237,849 in 1896–97. The proportion of persons successfully vaccinated per 1,000 of the population was, however, greater than in the preceding year in all the provinces, except Bombay, the North-Western Provinces and Oudh, the Punjab and the Central Provinces.

The following statement shows in outline the comparative working of the Vaccination Department in the different provinces in 1896–97 and 1897–98 :—

Comparative statement of Vaccination in the different Provinces of India, excluding Ajmere-Merwara, in 1896–97 *and* 1897–98, *together with the death-rates from Small-pox during* 1896 *and* 1897.

Province.		Population.	Number of vaccinations performed.			Percentage of successful cases.		Persons successfully vaccinated per 1,000 of population.	Ratio of deaths from small-pox per 1,000 of population during the calendar years 1896 and 1897.	Average number of vaccinators employed in Department.*	Average number of operations per vaccinator.*
			Primary.	Re-vaccinations.	Total.	Primary.	Re-vaccinations.				
Bengal	1896-97	71,053,516	2,223,128	70,527	2,293,655	97·92	52·60	31·16	0·18	3,478	622
	1897-98	70,832,144	2,243,093	76,443	2,319,536	97·87	64·37	31·69	0·27	3,383	650
Assam	1896-97	5,634,258	250,897	7,525	258,422	97 47	93·10	44·65	1·09	227	1,103
	1897-98	5,634,258	272,707	11,207	283,914‡	98·77	90·96	49·61	1·08	222	1.065
North Western Provinces and Oudh	1896-97	47,146,033	1,443,731	84,747	1,528,478	90·72	61·89	28·89	0·91	878	1,740
	1897-98	47,146,033	1,318,912	66,093	1,385,005	89·66	63·47	25·97	1·86	866	1,599
Punjab	1896-97	20,724,940	673,078	229,335	902,413	93·22	59·76	36·89	2·19	303	2,959
	1897-98	20,724,940	633,015	214,284	847,299	94·37	60·75	35·10	0·78	305	2,772
Central Provinces	1896-97	12,228,289	367,821	45,988	413,809	95·99	77·48	31·79	0·82	260	1,519
	1897-98	12,944,805	347,210	51,489	398,699	96·67	87·70	29·42	0·38	274	1,391
Berar	1896-97	2,897,040	98,594	21,717	120,311	96·89	20·55	34·51	0·3	44	2,729
	1897-98	2,897,040	95,048	30,241	125,289	96·4	30·0	34·7	0·2	44	2,847
Burma	1896-97	8,146,855	396,132	27,116	423,248	92·41	58·01	46·86	0·35	161	2,629
	1897-98	8,146,855	405,469	26,081	431,550	94·56	59·74	48·97	0·41	167	2,526
Madras	1896-97	35,651,577	1,173,131	74,589	1,247,720	90·56	74·73	31·36	0·3	834	1,465
	1897-98	35,651,577	1,189,146	82,583	1,271,729	89·75	74·97	31·67	0·7	824	1,508
Bombay	1896-97	22,701,942	734,237	70,750	804,987	92·18	58·86	31·65	0·34	437	1,834
	1897-98	22,701,942	679,234	60,196	739,430	91·77	58·49	29·0	0·20	435	1,690
Coorg	1896-97	173,055	9,080	1,431	10,511	95·02	82·95	56·72	0·10	9	1,112
	1897-98	173,055	9,480	1,497	10,977	95·21	85·03	59·51	0·34	8	1,180
Total	1896-97	226,357,505	7,369,829	633,725	8,003,554	94·12	61·26	32·36	0·62†	—	—
	1897-98	226,852,649	7,193,314	620,114	7,813,428	93·91	64·47	31·54	0·75†	—	—

* Refers to Special Vaccination Establishment only. † Calculated on figures taken from Sanitary Reports.
‡ Including tea gardens.

Animal Vaccination.—The following paragraphs, which deal with the details of vaccination in the different provinces, show how rapidly bovine lymph is taking the place of humanized lymph in the protection of the masses in India. Calf lymph is used fresh—calf-to-arm, preserved in tubes without admixture, or mixed with glycerine, lanoline or vaseline.

The use of the vaseline admixture has, it seems, been confined to the Punjab. The ratio of success obtained with it was high, but the length of time it had been kept, and

the degree of temperature to which it had been exposed, are not noted; while it is observed that the proportion of cases in which the results were unknown is large.

In most provinces lanolinated lymph seems to be the favourite preparation. In Madras glycerinated and lanolinated lymph were both used, and the former was found generally to be the more efficient preparation, as the following statement indicates:—

		Glycerinated Lymph.		Lanolinated Lymph.	
		Number of cases.	Percentage of success.	Number of cases.	Percentage of success.
In districts	Primary and secondary operations.	592,203	88·5	89,806	87·1
	Revaccinations.	29,291	79·7	2,060	62·2
Operations performed by dispensary staff.	Total cases...	14,807	81·6	3,693	78·4
Operations in municipalities.	Total cases...	46,974	91·0	13,512	88·4

The bacteriology of bovine lymph has received much attention in European laboratories. Results in respect of the number and nature of the germs which may be present are conflicting, but there seems to be no doubt that glycerine destroys most, if not all, of them. Practically, however, it seems that danger is to be feared much more from dirty instruments, failure to cleanse the skin at the site of operation, and neglect of the vesicles, than from any germ likely to be found in lymph which has been carefully cultivated, collected and conserved.

Bengal.—During the official year 1897–98, the supervising staff of the Vaccination Department in Bengal comprised the Sanitary Commissioner, three Deputy Sanitary Commissioners, 48 District Civil Surgeons, 206 Native Inspectors and 14 Head Vaccinators; while the operating staff consisted of 85 Vaccinators paid by Government, 58 paid by District Boards, 245 employed by Municipalities or in connection with dispensaries, 3,240 men who are licensed to vaccinate for fees, and 1,101 Apprentices, a net decrease of 30 operators as compared with 1896–97. For the greater part of the year, however, the supervising staff were deprived of the services of two Deputy Sanitary Commissioners, as these officers had to be temporarily recalled to military duty on account of the strain on the military medical services during the disturbances on the frontier.

The aggregate number of operations performed by all agencies in the province was 2,319,536, as compared with 2,293,655 in the previous year, an increase which under all the circumstances of the province is certainly satisfactory. The increase was distributed over 27 districts, but in the remaining 22 and in Calcutta there was a decrease, which was most conspicuous in Chittagong, Shahabad, Noakhali, Dacca, Bankura, and Mymensingh. In Chittagong the decrease is attributable to the effects of the terrible cyclone which swept across the district in October 1897; and in Mymensing the falling off is ascribed to difficulty in getting about the district from the effect of the earthquake of June 1897 and floods. Elsewhere the decrease is ascribed to various general and local causes, such as the prevailing scarcity, emigration of the people and the presence of small-pox. The occurrence of small-pox, as pointed out by Major Dyson, should be a stimulus to vaccination rather than a hinderance, but in places such as the tributary States of Chota Nagpur, where the people are very ignorant, vaccination may, it appears, be entirely suspended during an outbreak of small-pox, the people refusing to be vaccinated, and preferring to rely on the performance of *pujas* to avert the disease.

The number of successful primary operations was 2,195,509, or 18,694 more than in the previous year, but the proportion of success was slightly less; in 1896–97 the percentage of operations successful was 97·91, in 1897–98 it fell to 97·87. This falling off is only apparent, being due to the inclusion as failures of cases, the results of which were unknown in calculating the ratios. The total number of re-vaccinations performed during the year was 76,443, nearly six thousand more than in 1896–97. Of these,

64·36 per cent. were successful, against 52·59 in the previous year. The high degree of success is ascribed to the re-vaccination of numerous adults in whom the protective effect of primary vaccination in infancy was disappearing.

Estimating the number of births at 40 per 1,000 of the census population, 17·8 per cent. of the infants born were protected, against 17·6 per cent. in 1896–97, 14·7 in 1895–96, and a mean of 12·8 in the three years 1892–93 to 1894–95.

No inspection was done by Deputy Sanitary Commissioners on account of their absence on duty in connection with plague and their recall to military employment. An Assistant Surgeon, who was in charge of the Western Bengal Circle during part of the year, verified 4,227 operations in Manbhum and Chota Nagpur, about ·18 per cent. of the total number of operations. The proportion inspected by Civil Surgeons fell from 9·56 in 1895–97 to 9·34. The number of cases verified by Civil Surgeons was upwards of 10,000 in five districts, as compared with four in the previous year, including Muzaffarpur and Dacca, where Major Peck and Lieutenant-Colonel Macrae each verified upwards of 15,000 operations. In nine districts, as compared with 13 in 1896–97, the numbers verified were between 10,000 and 5,000; in 29 districts between 5,000 and 1,000, and in five districts the number was less than 1,000. The percentages of inspections by District Inspectors and Sub-Inspectors rose from 38·47 and 65·34, respectively, to 40·76 and 67·44 in 1897–98.

There was no change in the method of vaccination in use in the province, but orders were about to issue prescribing three punctures in each arm instead of two. Vaccination with lymph taken direct from the calf is extending, and there was an increase, as compared with 1896–97, of 25,681 primary operations, and 5,228 re-vaccinations by this method, which is about to be introduced into all districts were the prejudices of the people are not such as to render the introduction inexpedient in the present state of public feeling on account of the measures which are necessary against plague.

As compared with the previous year, there was a slight falling off in the amount of lanoline paste manufactured at Calcutta, but there was a considerable increase at Darjeeling. Five hundred and sixty-four grains of lanoline paste were supplied to the Nipal Darbar from the Darjeeling depôt.

Assam.—The vaccination staff of the province consisted of 18 Native Inspectors, 182 paid Vaccinators, 30 licensed Vaccinators and 10 Apprentices. The number of operations performed by them rose from 250,350 in 1896–97 to 255,583, but the average number of operations per vaccinator fell from 1,103 to 1,065. Of the total, 245,381 were primary vaccinations and 10,202 were cases of re-vaccination, the percentages of success claimed being, respectively, 98·98 and 92·05, against 97·58 and 94·25 in 1896–97. These ratios, even though supported in respect of primary cases by the verifications of Civil Surgeons, are, of course, suspiciously high; and, during his tour in the Nowgong District, the Sanitary Commissioner found that, while the work was really excellent, the results in some of the comparatively small number of cases seen by him were unsuccessful.

The Chief Commissioner, writing of inspections by Civil Surgeons, observes that "there is reason to believe that in many instances the results of these inspections are "misleading, only successful cases having been brought before the Civil Surgeons for "examination." Further instructions have been issued to secure that the work done by vaccinators shall be more effectively tested in future.

There was a great increase in the number of operations performed by Civil Surgeons and subordinates attached to dispensaries, the number rising from 8,072 in 1896–97 to 17,177 in 1897–98. Of these 16,172 were primary cases, of which 97·66 per cent. proved successful, and 1,005 were re-vaccinations, of which 79·9 per cent. succeeded. The ratios of success obtained in the previous year were, respectively, 94·26 and 76,35 per cent.

The number of operations performed by tea-garden agencies was 11,154, or 5,120 less than in 1896–97. All were primary cases, and 95·88 per cent. were successful.

During the year the Compulsory Vaccination Act was introduced into the Nowgong Municipality, raising the number of towns, cantonments, &c., in which the Act is in force to 13. Notwithstanding this extension, the total number of operations performed in the areas of compulsory vaccination was less than in any of the preceding three years; the number in 1897–98 having been 3,487, against 4,152 in the previous year. Nearly six hundred notices were issued under the Act, and 25 prosecutions were instituted, but in only two instances were the defaulters punished.

The number of infants protected was 25·9 per cent. of the births, estimated at 40 per 1,000 of the census population, as compared with 20·4 in 1896–97, 20·9 in 1895–96, and 17·6 the mean of the three years 1892–93 to 1894–95.

Omitting the operations performed by the tea-garden agencies, 8·87 per cent. of the remaining operations were verified by Civil Surgeons, and 55 per cent. by Native Superintendents or other inspecting officers ; the percentage of cases found successful by the former was 98·66, and by the latter 98·14.

Inoculation continues to be practised in Sylhet, Cachar and Lakhimpur. The Civil Surgeons of Sylhet and Cachar state that no outbreak of small-pox was traced to the practice ; but the Inspector of Vaccination in Lakhimpur, who was sent to investigate an outbreak in the village of Kathalguri, " gave reasons for supposing that the outbreak took " its rise from persons who had been recently inoculated."

The working of the bovine lymph depôt at Shillong continued satisfactory, and the lymph supplied throughout the season was reported by Civil Surgeons to be of excellent quality. With the exception of 3,277 successful operations in Sylhet and 7 in Goalpara, performed by the arm-to-arm method, all the operations in the province were done with lymph prepared in Shillong. Endeavours were made at the head-quarter stations of districts to carry on vaccination with fresh calf lymph, but the attempts were abandoned on account of the difficulty in obtaining calves and of the strong prejudice of the people. The Chief Commissioner, however, believes that with the exercise of tact and perseverance these difficulties might be overcome ; but in view of the great success obtained with the preparation prepared at Shillong, the introduction of the calf-to-arm method does not seem to be necessary.

North-Western Provinces and Oudh.—The vaccination staff under the control of the Sanitary Commissioner of these provinces comprised 865 operators under the supervision of two Deputy Sanitary Commissioners, 46 Civil Surgeons and 50 Assistant Superintendents of Vaccination. Owing to the absence of a considerable number of the supervising staff and operators who were deputed to plague duty, to the lower birth-rate of the year, and to the unfitness of many children for operation due to their reduced condition on account of famine, the total number of operations fell from 1,527,308 in 1896–97 to 1,384,660 in 1897–98, and the average number performed by each vaccinator from 1,739 to 1,599. Of the total number of operations, 1,318,615 were primary and 66,045 were re-vaccinations, and the ratios of success obtained were, respectively, 93·74 and 68·20 per cent. Medical subordinates attached to dispensaries performed 297 primary operations and 48 re-vaccinations, of which 90·46 per cent. of the former and 60·00 of the latter succeeded.

The number of infants successfully vaccinated by all agencies was 551,296, or 27,094 fewer than in the previous year. About 29·23 per cent. of the infants born, estimated at 40 per 1,000 of the population, were protected during the year, against 30·7 in 1896–97, 30·2 in 1895–96, and 26·6 the average of the three years 1892–93 to 1894–95.

There was a considerable decline in the vaccination work performed in municipal towns, and the attention of Superintendents was again called to the necessity for the proper administration of the Act.

The Deputy Sanitary Commissioners and Civil Surgeons were so fully occupied with duties in connection with the prevention of plague that they had little time to devote to the inspection of vaccination, and it is satisfactory, in view of the circumstances, that they were able to verify 6·31 per cent. of the operations. Native Superintendents verified 26·98 per cent. of the operations, and found 91·74 per cent. of the cases seen by them to have been successful, against 90·92 per cent. found successful by the Deputy Sanitary Commissioners and Civil Surgeons.

The supply of lymph from the hills was generally sufficient and satisfactory. The establishment of a depôt at Muktesar had to be postponed in favour of more urgent work, but the scheme is ready and complete. The depôt at Lucknow was satisfactorily worked.

Punjab.—There was no change in the number of the supervising staff, which, as in the previous year, consisted of the Sanitary Commissioner and his deputy, 31 Civil Surgeons, 6 Divisional Inspectors, and 34 District and Native Supervisors, but the Deputy Sanitary Commissioner and some of the Civil Surgeons were absent on plague duty for a great part of the year. The operators numbered 305, against 303 in 1896–97 ; 278 employed as district vaccinators, 21 employed by the special staff and 6 in cantonments. There was a large falling off in the total number of operations performed, which aggregated 845,491, against 902,413 in the previous year. Primary operations were less by 41,304,

re-vaccinations were less by 15,618. The decrease is attributed in part to high infantile mortality, and in part to failure of lymph and carelessness of the operators, the latter cause being largely effective because of the absence of the completer supervision of former years. The decrease of primary operations was common to the district and dispensary vaccinators, by whom 553,317 and 1,241 operations were performed, as compared with 596,686 and 3,737 in 1896–97. The numbers of operations performed by the special staff and cantonment vaccinators, however, rose from 67,780 and 4,875 in the previous year to 72,031 and 5,185 in 1897–98. The Deputy Sanitary Commissioner, it must be noted, suspects that the returns furnished by the special staff have been exaggerated, as there was insufficient check on their work during the winter months. The number of re-vaccinations performed by all agencies fell off. The quality of the work, as distinguished from the quantity, improved, the percentage of success in primary cases rising from 93·22 to 94·40, and in re-vaccinations from 59·76 to 60·77. In the eight large native states which maintain their own vaccination establishments, the numbers of operations performed were 86,334 primary and 45,539 re-vaccinations, successful at the rates, respectively, of 95·47 and 50·52 per cent. Among these states the largest number of operations was performed in Patiala, where the total amounted to 98,674, with 96·18 per cent. of success in primary vaccinations and 50·16 in re-vaccinations, against 95·46 and 47·63 respectively, in 1896–97.

About 57·5 per cent. of the infants born, reckoned at 40 per 1,000 of the census population, were successfully vaccinated, as compared with 58·5 in the previous year, 58·8 in 1895–96, and 52·4 the mean of the three years 1892–93 to 1894–95.

Civil Surgeons verified 8·66 per cent. of the primary operations and 2·25 per cent. of the re-vaccinations ; Divisional Inspectors verified 17·94 per cent. of the primary cases, and 25·85 per cent. of the re-vaccinations ; and Native Supervisors inspected 61·10 and 23·73 per cent. of the primary and re-vaccination cases respectively. It is observed that in all cases the inspecting officers found a higher rate of success than had been claimed by the vaccinators. This, while at first sight satisfactory, points to the selection by the operators of cases for inspection, and to the desirability of instituting test inspections where every case in a village would be examined, and not only a selected few.

Three kinds of lymph were in use, namely, humanized lymph, fresh calf lymph, and calf lymph mixed with vaseline. Of the primary operations about 83 per cent. were performed with fresh calf lymph, 11·5 per cent. with vaseline lymph, and 5·5 per cent. with humanized lymph. The fresh calf lymph was the most efficient, no less than 99·3 per cent. of the cases in which it was used being successful. Humanized lymph came next, with 98·2 per cent. of successes. The vaseline preparation was much inferior to the other two, and operations with it succeeded at the rate of 94·3 per cent. only. Of the re-vaccinations 76 per cent. were performed with fresh calf lymph, 13 per cent. with humanized lymph, and 11 per cent. with vaseline lymph. In these cases the humanized lymph proved the most effective with 78·7 per cent. successful ; the vaseline lymph came next with 75·6 per cent. ; and was closely followed by the fresh calf lymph, with 74·8 per cent. The comparative inefficiency of the vaseline lymph in primary operations is ascribed by the Deputy Sanitary Commissioner to its often having been kept some time before it was used.

The vaseline lymph was prepared at the Amritsar depôt in the cold weather, and at the Murree depôt in the hot weather. Altogether 2,850 ten-grain tubes were sent to the districts, and in 1,349 instances the results obtained with the contents were successful. The contents of only 62 tubes, all sent out from the Murree depôt, failed ; but the results attained were unknown in a very large number of cases, especially in respect of tubes prepared at Amritsar. There was a considerable decrease in the total cost of the Department, owing to the absence for about five months of the Deputy Sanitary Commissioner.

Central Provinces.—The statistics of 1897–98 include the Native States of Sonepur and Bamra, excluded in 1896–97 in consequence of the non-receipt of returns from these States. The inspecting staff in the Central Provinces remained unchanged, and comprised 19 Civil Surgeons and 28 Native Superintendents ; but the average number of operators was 274, or 14 more than in 1896–97. The total number of operations was 384,476, or 12,560 fewer than in the previous year, and the average number performed by each vaccinator fell from 1,519 to 1,391. The falling off in numbers, although common to the British districts and Feudatory States, was confined to primary operations, and was due to the reduced birth-rate and other consequences of famine, and to the temporary withdrawal of members of the vaccination establishment for employment in connection with the famine and the prevention of plague.

Of the 306,673 operations performed in British territory, 268,271 were primary and 38,402 were re-vaccinations, the percentages of success claimed being, respectively, 96·73 and 85·84, a slight increase in the case of the former, and a very marked increase in the case of the latter, on the percentages of the previous year, which were 96·00 and 71·70. In the Feudatory States the total number of operations was 77,803, of which 65,622 were primary operations and 12,181 re-vaccinations, the ratios of success being 96·86 and 94·27 per cent., as compared with 97·20 and 96·01 in 1896-97.

There was a total decline of 2,550 operations as compared with the previous year in the work done by dispensary staffs. In British territory 10,998 primary operations and 848 re-vaccinations were done by them, the percentages of success being, respectively, 95·46 and 77·48. In the Feudatory States the number of primary operations performed by dispensary establishments was 2,319, of which 90·86 per cent. succeeded. Re-vaccination was limited to the State of Sarangarh, where 53 of 58 operations proved successful.

Estimating the birth-rate at 40 per 1,000 of the census population, the percentage of children born who were protected was 36·20, against 47·5 in 1896–97, 49·3 in 1895–96, and 52·9 the mean of the three years 1892–93 to 1894-95. It must be remembered in this connection that there has for some years past been a declining birth-rate in the Central Provinces.

As compared with the previous year, there was an improvement in the work of inspection. About 18·79 per cent. of the operations were examined by Civil Surgeons, and 55·45 per cent. by Native Superintendents, as compared with 15·78 and 50·24, respectively, in 1896–97. The percentage of success found by Civil Surgeons was 92·40, and by Native Superintendents 93·45, against 92·01 and 93·46 in the preceding year.

Fresh calf lymph, calf lymph mixed with lanoline, and humanized lymph were used. There is no considerable prejudice against the use of calf lymph in the Central Provinces, and the vast majority of the operations were performed with it, although it is not distinctly brought out in the report what numbers of cases were vaccinated with the fresh and stored calf lymph, respectively.

Berar.—The Vaccination Department under the control of the Sanitary Commissioner of Berar, comprised, as in the previous year, 44 operators under the supervision of seven Native Superintendents. The total number of operations performed was 125,289, or 5,178 more than in 1896–97, and the average number performed by each vaccinator was 2,847, against 2,729. The increase was due to re-vaccinations alone, the number of which rose from 21,717 in 1896–97 to 30,241. Primary operations numbered only 95,048, or 3,546 less than in the previous year, the falling off being satisfactorily explained by the high mortality among children. Primary operations were slightly less successful than in 1896–97, the percentage of success falling from 96·8 to 96·4; on the other hand, re-vaccinations were much more successful, the percentage rising from 20·5 to 30. Estimating the birth-rate at 40 per 1,000, about 63·4 per cent. of the infants born were protected, against 66·8 in 1896–97, 58·2 in 1895–96, and 60·9 the mean of the three years 1892-93 to 1894-95.

The Sanitary Commissioner's inspections were limited to the Amraoti District, where 99·8 of the operations verified by him were successful. Native Superintendents verified 53·1 per cent. of all the operations, or 2·7 less than in the previous year, and found successful results in 94·3 per cent. Operations seem to have been performed exclusively with calf lymph, either fresh or lanolinated.

Lieutenant-Colonel Little gives an interesting table showing the relation of vaccination to small-pox mortality in Berar since 1868–69, which, with his remarks on it, is reproduced.

Year.	Ratio per 1,000 successfully vaccinated.	Death-rate per 1,000 from small-pox.	Year.	Ratios per 1,000 successfully vaccinated.	Death-rate per 1,000 from small-pox.
1868–69	4·3	1·9	1873–74	14·5	3·8
1869–70	3·2	3·6	1874–75	21·0	·5
1870–71	7·9	·6	1875–76	24·0	·4
1871–72	13·0	·2	1876–77	31·0	·2
1872–73	16·2	3·8	1877–78	38·0	2·9
Mean ...	8·92	2·02	Mean ...	27·72	1·56

Year.	Ratio per 1,000 successfully vaccinated.	Death-rate per 1,000 from small-pox.	Year.	Ratio per 1,000 successfully vaccinated.	Death-rate per 1,000 from small-pox.
1878–79	22·3	2·7	1888–89	36·1	·3
1879–80	29·3	·03	1889–90	55·68	·7
1880–81	33·9	·02	1890–91	34·3	·2
1881–82	32·5	·08	1891–92	36·0	·01
1882–83	38·0	·1	1892–93	37·0	·02
Mean ...	31·2	·58	Mean ...	35·8	·2
1883–84	30·3	1·5	1893–94	35·0	·06
1884–85	37·0	·2	1894–95	32·2	·3
1885–86	35·3	·09	1895–96	31·8	·2
1886–87	35·6	·04	1896–97	34·5	·2
1887–88	35·2	·1	1897–98	34·7	·2
Mean ...	34·68	·38	Mean ...	33·6	·19

Beginning with the quinquennial period 1869 to 1873, it will be seen that the small-pox death-rate was 2·02 per 1,000 of population, and that in each period of five years it has steadily declined as vaccination has advanced, till for the period ending 1898 it has been 0·19 per 1,000.

It may be noted that small-pox inoculation never prevailed in Berar, and that the disease is quite as virulent amongst the unvaccinated as it ever was. There is nothing but vaccination to which this great diminution of small-pox mortality can be attributed. The above figures tend to prove the axiom that in countries where there is much vaccination and re-vaccination relatively to the population there is but little small-pox.

Madras.—The inspecting staff in Madras consisted of one Deputy Sanitary Commissioner, the District Medical Officers and 60 Deputy Inspectors. The average number of Vaccinators employed was 824, or 10 less than in 1896-97. Notwithstanding the reduction in the number of operators, the number of operations rose from 1,234,350 in the previous year to 1,258,010 in 1897–98, the average number performed by each operator rising from 1,465 to 1,508. The increase was not, however, general, but was limited to 11 districts and certain of the municipalities and cantonments. In 10 districts and in 31 municipalities there was a falling off, ascribed to a variety of causes ; among them, the prevalence of famine, the presence of cholera, failure of lymph, the opposition of the people, and the lack of help received from heads of villages.

Of the total number of operations, 1,177,100 were primary, of which 92 per cent. were successful, and 80,910 were re-vaccinations, in which the ratio of success was 81 per cent., as compared with percentages of success obtained in 1896-97 of 92·6 and 80·2 respectively. Besides the above, 13,719 operations were performed by the establishments attached to dispensaries, a slight increase of 349 over the number performed by them in the previous year. The percentages of success reached in dispensary vaccination were, however, lower than in 1896-97, having been, in primary cases, 83·5, against 88·0, and in re-vaccinations, 72·8, against 74·8.

In all, 331,297 infants under one year of age were successfully vaccinated. This is equal to about 23·23 per cent. of the births, estimated at 40 per 1,000 of the census population, as compared with 23·20 per cent. in 1896-97, 22·0 in 1895-96, and 18·6 the mean of the three years 1892–93 to 1894–95.

During the last nine months of the official year the Deputy Sanitary Commissioner was employed on duty outside the Presidency, in connection with plague, and was unable to carry out any inspection. The percentages of cases verified by Civil Surgeons and Native Superintendents and others were much the same as in the previous year, namely, 2·5 and 49·7. The ratio of success in the cases examined by Civil Surgeons was 92·3 per cent., and in those examined by the Native Superintendents 89·1, as compared with 90·8 and 89·5 per cent. found successful by these officials, respectively, in 1896–97.

Humanized lymph was not used anywhere in the Presidency. In all operations performed during the year animal lymph was used, either (*a*) fresh calf-to-arm, (*b*) stored in tubes without admixture, (*c*) mixed with glycerine and stored in tubes, and (*d*) mixed with lanoline and stored in tubes.

The results obtained with the various vaccines used in the districts, excluding dispensaries and municipalities, is shown in this statement :—

—	Number of Cases.	Percentage of Success.
(*a*) Fresh lymph	302,225	97·9
(*b*) Lymph without admixture ...	·126,683	95·9
(*c*) Glycerinated lymph...	621,494	88·1
(*d*) Lanolinated lymph	91,866	86·6

As in former years, lymph taken direct from the calf secured the best results. It will be observed that the positions held by glycerinated and lanolinated lymph have been reversed, due to a great falling off in the percentage of success obtained in 1897–98 with the latter. As compared with 1896–97, the percentage of success in operations with glycerinated lymph has fallen from 88·9 to 88·1, while the falling off with the lanolinated lymph is from 94·0 to 86·6.

Coorg.—The vaccination establishment under the control of the Civil Surgeon of the small province of Coorg consisted of an average of eight operators working under the supervision of a Native Superintendent. The total number of operations performed was 10,616, or 610 more than in 1896–97, and the average number done by each vaccinator rose from 1,112 to 1,180. Primary operations numbered 9,230, of which 95·80 succeeded; and 89·25 per cent. of 1,386 re-vaccinations were successful. Medical subordinates attached to dispensaries performed 250 primary vaccinations and 111 re-vaccinations, of which 73·60 and 32·43 per cent., respectively, succeeded.

Estimating the birth-rate at 40 per 1,000, which is, in this case, above the actual rate, only 13·10 per cent. of the infants born during the year were protected, against 18·6 in 1896–97, 17·2 in 1895–96, and 13·3, the mean of the three years 1892–93 to 1894–95. The falling off in infantile vaccination is attributable to the low birth-rate and to the exceptional insalubrity of the year, which led to the postponement of vaccination in many cases.

Calf lymph was used exclusively. About 1·55 per cent. of the cases were verified by the Civil Surgeon and 31·93 by the Native Superintendent, as compared with 1·24 and 33·41 verified by them, respectively, in 1896–97.

Bombay.—Excluding the Native States of Baroda, Cutch, Kathiawar, Palanpur and Idar, the returns from which are dealt with separately, the vaccination staff of the Bombay Presidency comprised, under the control of the Sanitary Commissioner, 5 Deputy Sanitary Commissioners, 1 Superintendent of Vaccination for the City of Bombay, 45 Inspectors of Sanitation and Vaccination, and 435 Vaccinators. The total number of operations performed was 736,409, as compared with 802,738 in the previous year, and the average number performed by each operator fell from 1,834 to 1,690. The falling off was general throughout the Presidency, and was due to the disturbing effects of famine and plague. Of the total number of operations, 675,901 were primary, 59,495 were re-vaccinations, and 1,013 were secondary operations, performed in cases in which the first operation had failed. The percentage of success in primary operations was 91·90, and in re-vaccinations 58·41, compared with percentages of 92·19 and 59·64 in 1896–97.

By dispensary establishments 3,021 operations were performed, of which 2,313 were primary, 655 re-vaccinations, and 53 secondary. The ratios of success attained were 95·98 and 69·77 per cent., against 85·67 and 76·13, respectively, in the previous year.

Estimating the births at 40 per 1,000, 55·54 per cent. of the infants born were protected, as compared with 59·1 in 1896–97, 58·0 in 1895–96, and 56·2 the mean of the three years 1892–93 to 1894–95.

The work of inspection suffered great interference from the effects of famine and plague. All the Deputy Sanitary Commissioners and many of the Inspectors were employed on plague duty during the year; moreover, owing to the absence of villagers from their homes during the famine, and the exodus from towns on account of plague, it was difficult

to find the children who had been vaccinated. The percentage of operations inspected by Deputy Sanitary Commissioners was only 1·18, and by Native Inspectors 31·79, as compared with 4·74 and 36·42 in 1896–97, and 7·03 and 37·67 in 1895–96.

Bovine lymph was used in the City of Bombay exclusively, and in selected areas elsewhere.

In the Native States of Baroda, Cutch, Kathiawar, Palanpur and Idar, not counting secondary operations, 213,299 vaccinations were performed, a reduction of 6,387 as compared with the previous year. Primary operations numbered 202,317, and re-vaccinations 10,989, with percentages of success, respectively, of 94·90 and 67·22, as compared with 94·13 and 69·50 in 1896–97. The number of infants protected was 161,278, or 236 fewer than in the preceding year.

Burma.—In 1897–98 the vaccination statistics of Upper Burma have been merged with those of the older province. The Department is administered by the Sanitary Commissioner with the assistance of the Civil Surgeons in their several districts and eleven Native Inspectors. In Rangoon Town the municipal vaccination establishment is under the immediate superintendance of the Municipal Health Officer. The average number of vaccinators employed was 167, as compared with 161 in 1896-97, and the total number of operations performed by them rose from 414,845 in that year to 421,786. Primary operations numbered 400,318, or 9,652 more than in the previous year, but the number of re-vaccinations was only 21,468, or 2,711 fewer. The increase in the number of primary operations, moreover, was not general, and there was a decrease in no less than ten districts, conspicuously in Rangoon, Pakokku, Thaton, Yamethin and Meiktila.

The interdiction of the compulsory vaccination of unprotected adults is to some extent, at any rate, responsible for the grave falling off in the number of vaccinations performed in Rangoon Town in recent years ; but as the Local Government is now taking steps to legalize (1) the vaccination of unprotected persons on board any ship on which small-pox has occurred, (2) the vaccination of unprotected inmates of cooly barracks and lodging houses, and also (3) the serving of notices requiring any unprotected person to be vaccinated within seven days, it may be hoped that the number of operations will increase again.

The ratios of success obtained were, in primary cases 94·56 per cent., and in re-vaccinations 61·38, as compared with 92·43 and 59·50, respectively, in 1896–97 ; the rise being ascribed to improvement in the quality of the lymph supplied from the depôts at Rangoon and Taunggyi.

There was a considerable increase in the number of operations performed by Civil Surgeons and medical subordinates attached to dispensaries, but more than half the total, which was 9,764, against 8,403 in the previous year, were performed in the three districts of Hanthawaddy, Thongwa and Sagaing. Primary operations numbered 5,151 and re-vaccinations 4,613, and 94·95 per cent. and 52·18, respectively, succeeded.

Of the estimated number of children born during the year 111,931, or 34·34 per cent., were protected, against 32·29 per cent. in the preceding year, 22·05 per cent. in 1895–96 and 15·79 per cent. in the three years 1892–93 to 1894–95.

No improvement seems to have been effected in the vaccination arrangements in the Shan States. Although there was some increase in the number of operations performed in the Northern Shan States, the proportion of success continued low and the check was insufficient. In the Southern Shan States there was a falling off in the numbers as compared with the previous year, attributed to the epidemic prevalence of cholera from May to September, in consequence of which the vaccinators were employed in looking after the sick and distributing medicines, while parents, in terror of the disease, would not allow the vaccination of their children.

Improvement is observable in the proportion of cases inspected. The percentage verified by Civil Surgeons was 12·58 and by Native Inspectors 16·52.

Lymph paste was prepared in the depôts at Rangoon and Taunggyi, whence most of the lymph used, which was generally of good quality, was supplied.

Inoculation is still practised in some places, and is said to have led in many cases to outbreaks of small-pox.

Ajmere-Merwara.—Vaccination in this small province is supervised by the Civil Surgeon of Ajmere, assisted by a Native Superintendent. The average number of Vaccinators employed in 1897–98 was 13, and the total number of operations performed

was 16,555, or 273 more than in the previous year. Nearly all were primary operations, which proved successful at the rate of 98·74 per cent.; of the 75 re-vaccinations, 46, or 61·33 per cent., succeeded.

The number of infants protected was 10,996, or about 50·6 per cent. of an estimated birth-rate of 40 per 1,000, as compared with 51·3 per cent. in 1896–97, 46·3 in 1895–96, and a mean of 40·5 in the three years 1892–93 to 1894–95.

Civil Sanitary Works.

Bengal.—As has been explained in previous reports, the figures regarding expenditure on sanitary improvement in Bengal have, since 1895 when the change was introduced, had reference to the financial year ending the 31st of March. In 1896–97, the number of municipalities in Bengal, excluding Calcutta, was 148, an increase of three as compared with the previous year, but the total income, including opening balances in both years, fell from Rs. 46,02,679 in 1895–96 to Rs. 43,49,548; this falling off was, however, almost entirely due to diminished borrowing from Government for capital expenditure. Of the total income about 46·76 per cent. was devoted to original and recurring sanitary works, 10·03 per cent. to roads, 4·49 per cent. to preservation of the public safety, and 28·61 per cent. to other requirements. The expenditure on water-supplies was Rs. 5,44,984, as compared with Rs. 9,96,441 in 1895–96, the large decrease being due to diminished capital outlay. On drainage, expenditure fell, for the same reason, from Rs. 1,49,559 to Rs. 1,21,060. On conservancy, there was an increase in expenditure from Rs. 8,88,026 to Rs. 9,21,519, due to the purchase of land for trenching purposes, and to the adoption of special measures for cleansing towns as a precaution against the invasion of plague.

The average proportion of municipal income expended on original sanitary works was only 3·70 per cent., against 5·03 per cent. in 1895–96. The reduction was general, for in 1895–96 upwards of 10 per cent. of their income was thus expended in seventeen towns, and in 1896–97 in only fifteen, including Meherpur (34·75 per cent.), Netrakona (32·43) and Patuakhali (26·16); while the number of municipalities, in which nothing whatever was so spent, rose from 28 to 37, and included such important places as Hooghly, Berhampur, Bettiah and Ranigunj.

The average proportionate expenditure on recurring sanitary works, however, rose from 37·64 to 40·20 per cent. of income, ranging from 65·14 per cent. in Jangipur, in the Murshidabad district, to 13·14 in Santipur in Nadia, and 8·92 in Netrakona in Mymensingh.

The expenditure of public funds on rural sanitation increased considerably, from Rs. 1,42,012 in 1895–96 to Rs. 4,00,272; and there was a still more remarkable and very gratifying increase in the amount provided by private benevolence, which rose from Rs. 4,94,131 to Rs. 11,72,068. Of this sum, Rs. 1,57,770 was spent on the construction of seven *bunds* in Darbhanga, and the greater part of the remainder was devoted to the excavation of tanks, works which not only furnished work for labourers in a year of famine, but will tend to the permanent improvement of the supply of water in the province.

The only large project completed during the year was the extension of the Bhagalpur water-works, at a cost of Rs. 2,70,955.

The constitution of the Board, and the duties assigned to it, remained unchanged. Owing to the absence of members from head-quarters there was the usual difficulty in arranging for meetings, and only two were held during the year; but in order to prevent the delay of business, papers were circulated among the members.

The following were the principal subjects of discussion at the two meetings of the Board:—

(1) The drainage and sewerage of Calcutta and the South Added Area.

(2) The drainage and sewerage scheme for Howrah; the Board considered that the sewerage scheme should be completed before the drainage works were commenced.

(3) The unfiltered water-supply of Calcutta and the South Added Area; the Board did not receive the complete papers until the work was considerably

advanced, and simply recorded their approval of the work, as, at the stage reached, no advantage could result from criticism of the plans and estimates.

(4) Bhagalpur water-works.

(5) Berhampur water-works.

(6) Darjeeling water-supply.

(7) The septic tank system of sewage disposal. The Sanitary Commissioner suggested that the Board should recommend Government to join with the Calcutta Corporation in making an experimental tank and filter; he was asked to submit an official communication on the subject for the consideration of the Board.

The principal estimates prepared were the following :—

(1) A water-supply scheme for the Garden Reach Municipality, to cost Rs. 50,000.

(2) Remodelling the Darjeeling water-supply scheme, at a cost of Rs. 1,10,000.

(3) A scheme for flushing the road-side drains of the Patna Municipality, to cost Rs. 56,000. The municipality being unable to afford such a large sum, a partial scheme was prepared to provide for the most offensive drains, but the Municipal Committee were enjoined to make every effort to provide funds for the whole scheme.

Estimates and plans were considered for :—

(1) The extension of the unfiltered water-supply in the town and suburbs of Calcutta.

(2) The supply of filtered water to Pabna.

(3) The construction of two tanks in Khulna.

(4) A drainage scheme for Baranagar and South Dum-Dum.

(5) The Cossipore and Chitpur drainage project.

(6) The drainage of Dainhat.

(7) The drainage and sewerage of Howrah.

An interesting experiment was carried out at Patna under the superintendence of the Board's Engineer. The Municipal Commissioners were desirous of ascertaining whether it would be possible to obtain water from the old bed of the River Sone, and so avoid resorting to the Ganges for a supply. A series of borings were made to the west of Bankipore, which showed that a great thickness of river sand was to be found at a few feet from the surface, and that water was standing from 10 to 12 feet below ground level. A masonry well was sunk from which water was continuously pumped for ten hours daily for more than a month. The results showed that an ample supply of pure water could be obtained, and the municipality were requested to supply a map of the town and certain information to enable the Board to prepare an estimate.

In connection with the biological treatment of sewage, a coke-breeze filter for urine and sullage water, which had been working at Dacca during the previous year, proved so satisfactory, that a circular was issued bringing the method to the notice of all municipalities and local officers. It is hoped that the matter will receive the attention that its importance deserves.

The Board furnished advice on a number of miscellaneous questions submitted to them by Government and various local bodies, and their Sanitary Engineer made numerous valuable inspections.

Assam.—The total income of the municipalities, towns, stations and unions in Assam in 1897 was Rs. 2,58,169, as compared with Rs. 2,62,416 in the previous year. The amount spent on sanitary works proper was Rs.1,13,543, or 43·98 per cent. of income, against 46·10 per cent. in 1896. The highest percentage of income set aside for sanitation was 73·89 in Gauhati, the lowest, 21·69 in Sylhet. No important sanitary work was put in hand during the year on account of lack of funds, but efforts were made to improve existing sources of water-supply and arrangements for conservancy. The protected water-supplies at Gauhati and Shillong suffered considerable damage during the earthquake, but they were speedily put in order again, although the pumping machinery at Gauhati is old and worn-out and will soon require to be renewed. In rural areas the principal improvements

consisted in the excavation of tanks and the repair of wells ; a few small drainage works were also undertaken. It is satisfactory to learn that Local Boards, generally, are alive to the importance of such matters and are willing, when they can, to spend money on them.

The Chief Commissioner had under consideration a draft Village Sanitary Regulation, prepared by the Sanitary Board on the lines of the North-Western Provinces and Oudh Sanitary Act II of 1895 ; but rejected it on the ground that no Regulation of the kind is suitable to the sparsely populated hills and jungles of Assam.

No meeting of the Sanitary Board was held, but the opinions of members on all important sanitary matters under discussion were obtained unofficially.

North-Western Provinces and Oudh.—The income of the 103 municipal towns in these provinces during the financial year 1896–97, excluding opening balances, was Rs. 41,52,909, nearly eleven and a half lakhs less than in the previous year ; and the expenditure on sanitary works fell from Rs. 24,63,595 to Rs. 21,79,902. There was a reduction in the expenditure under all main heads, except conservancy. On water-supply Rs. 8,90,523 were spent, as compared with Rs. 10,97,305 ; on drainage Rs. 3,15,108, against Rs. 4,30,079 ; on markets and slaughter-houses Rs. 35,843 against Rs. 47,723 ; on conservancy the sum advanced from Rs. 8,88,488 to Rs. 9,38,428.

No new work of any magnitude was begun during the year, nor was any completed, except the extension of the Allahabad water-supply to Daraganj ; and the following notes refer to the progress of existing works during the year ending 31st March 1898. At Agra, the daily average consumption of filtered water fell from 1,520,115 to 1,338,177 gallons, equal to 7·89 gallons per head per diem of the census population ; in the cantonment the daily average consumption of filtered water rose from 164,702 gallons to 185,718. The maximum consumption in the city and cantonment on any one day was 2,325,991 gallons. The engines and filters are designed to meet a maximum daily demand of only 1,500,000 gallons, and although, by working extra time, the engines can pump up a larger quantity, the area of the filters is too small to allow its being sufficiently slowly filtered. There is a peculiar danger attending over-rapid filtration at Agra, for the stream of the Jumna is very small during the hot weather and the water is liable to be very impure. The urgent necessity for the provision of an additional filter has been pointed out to the Municipal Board, but want of funds is in the way.

The actual cost of the filtered water was 1·80 anna per 1,000 gallons ; but, calculated on the net expenditure, including interest and sinking-fund charges, the cost was 3·43 annas.

At Allahabad, notwithstanding the extension of the municipal mains to Daraganj, which derived its supply of water from the city water-works from October 1897, the consumption of filtered water fell from an average of 1,600,288 gallons a day to 1,425,164, between 8 and 9 gallons a head of the population. The falling off was due in part to the higher rates charged for water for use in gardens, in part to shortened hours of supply in the beginning of the year, but chiefly, it is satisfactory to note, to the prevention of waste.

At Benares, the daily consumption of water rose from an average of 1,768,394 gallons in 1896–97 to 1,905,216, equal to 9·05 gallons per head of the population. Each thousand gallons cost 1·34 anna, not reckoning interest and sinking fund payments ; if these are taken into account, the cost was 2·27 annas. The principal work in progress during the year was the construction of a raised reservoir for maintaining a constant supply. This reservoir is estimated to cost Rs. 79,362, and should have been finished in July 1897, but, owing to delay on the part of the contractors, it was not expected to be ready before the end of July 1898.

At Cawnpore, the daily consumption of water increased slightly from 1,306,426 to 1,325,409 gallons, or 8·09 gallons per head. The receipts are still low as compared with other towns and the cost of the water is consequently high.

At Dehra Dun, the average daily supply was equal to 6 gallons per head. The supply was scanty during part of the hot weather, not due to failure of the spring, but to lack of supervision.

At Lucknow, the total quantity of water pumped into the mains was 346,581,925 gallons, of which 63,058,814 gallons were supplied to the cantonment. The average daily consumption in the city was 776,776 gallons, equal to 4·8 gallons a head, as compared with 2·95 in the previous year.

At Meerut, the average daily supply was 461,899 gallons, compared with 350,508 in 1896–97, or 6·3 gallons per head of the census population, against 4·55 in the previous year. The cost of delivery, excluding sinking-fund and interest charges, was 1·7 anna

per 1,000 gallons, and it is expected, when the supply is extended to the cantonment, that this will not exceed one anna.

At Mussoorie, the daily average supply was equal to about 7 gallons a head.

At Naini Tal, the total quantity of water pumped was 6,192,830 gallons, costing about 17 annas a head of the population. Several improvements to the existing works were made during the year, and a detailed project of reconstruction and extension was prepared.

The water supplied to the towns generally during the year is reported to have been good, but at Agra, Allahabad and Lucknow microbes, resembling that associated with the causation of enteric fever, were detected in the supply, and measures to remedy defects, which may have led to their presence, were in each case undertaken.

Progress was made with the Benares sewage project, mainly in the construction of branch sewers in the unsewered area. The Bhilaru sewage shoot at Mussoorie was in course of construction, but work was unfortunately delayed by severe weather in the winter. The town of Jhansi was surveyed and a scheme for a supply of water to be pumped from wells was prepared. Surveys for the surface drainage of Deoband, Aligarh, Saharanpur and Fyzabad were in progress or completed.

The members of the Sanitary Board met twice during the year, and the following were the more important matters discussed by them :—

1. Posting of Assistant Surgeons to districts as "Sanitary Assistants." The proposal was to post the Assistant Surgeons to ten selected districts, but it was resolved to recommend to Government that one Assistant Surgeon should be appointed for all three hill districts ; that an Assistant Surgeon should be posted to Basti, and another to Azamgarh on account of the density of the population of these districts and the frequency in them of epidemic diseases, and that an Assistant Surgeon should be posted to each of the other seven districts specified by the Inspector-General of Hospitals—a distribution of the ten Assistant Surgeons to twelve districts.

It was further resolved,

(*a*) that in the remaining thirty-six districts, Hospital Assistants, selected on account of their knowledge of sanitation, should be appointed ;

(*b*) that Assistant Superintendents of Vaccination could not be dispensed with if the registration of vaccine operations was to continue true and accurate, and that such posts should be given to selected vaccinators ; and,

(*c*) that a lectureship on Hygiene should be established at the Agra Medical School.

2. A memorandum, prepared by the Sanitary Commissioner on the subject of the disposal of night-soil in municipalities, was circulated for the guidance of Municipal Boards.

3. The high rate of mortality in the town of Deoband was attributed to inefficient drainage, due to the want of a proper outfall under the North-Western Railway, and the railway authorities were addressed with a view to measures being taken to improve the outfall before the next rainy season.

4. The question of employing a mechanical engineer for the supervision of the pumping machinery of the various water-works was referred to the Municipal Boards concerned, to ascertain whether they would contribute towards his pay.

5. It was recommended to Government that, in view of the increase in the statistical work in Civil Surgeons' offices, each Civil Surgeon should be allowed an additional clerk.

Punjab.—The total income of the 31 municipal towns in the Punjab in 1897, including an opening balance of Rs. 10,92,066, was Rs. 52,95,950, a falling off due to a smaller opening balance of about a lakh as compared with the previous year. Of the total, Rs. 2,17,183 were expended on water-supply, against Rs. 1,66,744 in the previous year ; Rs. 1,02,847 on drainage and sewerage, against Rs. 1,26,608 ; and Rs. 6,35,308 on conservancy, against Rs. 5,83,174 ; the total sanitary charges aggregating Rs. 11,67,891, as compared with Rs. 12,36,690 in 1896.

The amount realised from the sale of manure and street sweepings was Rs. 1,49,120, an increase of upwards of Rs. 13,000 as compared with the previous year.

No new sanitary undertaking of any magnitude appears to have been begun during the year, but the Pind Dadan Khan water-supply scheme was completed; two storage tanks in connection with the Bhiwani water-supply project were excavated; and the water-supply of Kohat was extended to the cavalry lines, to the *katcheri* and to the charitable dispensary. Improvements to the Peshawar supply were effected; experimental borings in connection with the Amritsar water-supply scheme, now ready for submission to Government, were made; estimates for the Delhi water-supply extension scheme were submitted to the Local Government; experiments were made in connection with a scheme for Mooltan; and a project to supply the cantonment of Mian Mir was being prepared.

A sum of Rs. 78,214 was spent on the Lahore sewage and drainage scheme; and a tramway project for the improvement of the scavenging of Lahore was being prepared for the approval of the Sanitary Board. A large egg-shaped intercepting sewer was constructed in Jhelum; and a number of drains were constructed in Peshawar City, at a cost of Rs. 10,633. Drainage schemes for Mooltan, Rawalpindi, Hazro, Delhi (Chandni Chauk), Balabgarh, Jagraon, Raikot, Fazilka, Muktsar and Batala were under preparation, and schemes for the drainage of Ferozepore City and Cantonment, and of Ladwa were under consideration.

The sewage farm, in the neighbourhood of Delhi, was so far a success that all the filth of the city was disposed of without causing any nuisance.

One hundred copies of the village sanitary inspection books were supplied to Deputy-Commissioners. These books have been kept up in many villages and "have proved "useful in giving important sanitary information to the inspecting officers at the time of "their visit to the villages."

Only one meeting of the Board was held during the year. The following subjects were discussed:—

1. The excessive mortality from fevers in the province.
2. The unhealthiness of the villages in the Neli Circle tract in the Kalsia State and British Territory. It was recommended that quinine should be distributed gratuitously to the villagers all the year round.

A good many papers, of which the greater number related to sanitation in Bengal and the North-Western Provinces and Oudh, were circulated among the members of the Board.

Central Provinces.—The total income of the nineteen *Sadar* towns in the Central Provinces fell from Rs. 16,26,680 in 1896 to Rs. 14,10,350, but the expenditure on sanitation rose from Rs. 2,79,252 to Rs. 2,88,047, the outlay on water-supply being Rs. 61,437, against Rs. 52,420 in 1896; on conservancy Rs. 2,03,702, against Rs. 2,05,089; on buildings Rs. 4,887, against Rs. 16,895. No project of capital importance was undertaken during the year, but progress was made with the water-supply and drainage schemes at Jubbulpore, and with the Wardha water-works which have since been completed. The carrying out of the water-supply scheme at Harda had to be deferred owing to lack of funds.

Of Rs. 94,566, allotted during the year for expenditure on village sanitation, only Rs. 38,845 were spent, about two-thirds on water-supplies, and the balance on site-cleansing, drainage and roads. Progress was made in the record of notes on village sanitation, but the inspection of minor villages was restricted on account of the special duties in connection with the famine and precautionary measures against plague, which engaged the attention of the sanitary staff.

The constitution of the Board remained unaltered; the members met once at each divisional head-quarters, and were mainly occupied with minor projects for the improvement of villages.

Berar.—The income of the municipal towns in Berar was Rs. 2,67,286 as compared with Rs. 2,42,922 in 1896. The proportion devoted to sanitation was somewhat less in 1897 than 1896—71 per cent., as compared with 74, but the actual sum expended was Rs. 1,69,159, only Rs. 1,356 less. The decrease in expenditure was under the heading "water-supply," Rs. 57,904 having been spent, against Rs. 71,180 in the previous year; under the other heads expenditure was larger, on conservancy Rs. 66,853, against Rs. 59,988; on drainage Rs. 10,592, against Rs. 10,208, and on other sanitary works Rs. 33,810, against Rs. 29,139.

No new work of importance was begun during the year, and the principal item of expenditure was a sum of about Rs. 25,000 for repairs to the Khamgaon tank, undertaken as a relief work. Considerable improvements were made in the drainage arrangements of the towns, and a scheme for the drainage of Amraoti, prepared by Dr. Khote, chairman of the sub-committee for sanitation in that municipality, is under consideration.

Night-soil is trenched and cropped in most towns, but owing to the want of rain in 1897 the crops obtained were unsatisfactory, except at Shegaon where there was a fair yield of tobacco. Sufficient attention has not as yet been given by all the committees to the disposal of night-soil, and the filth will be got rid of more effectively and the profits to the towns will be greater when the needed improvements are brought about.

The income of the District Boards is said to be about six-and-half lakhs. In 1897, Rs. 1,05,475 was devoted to sanitation, against Rs. 82,695 in the previous year. The principal expenditure was Rs. 55,939 on water-supplies, against Rs. 28,950 in 1896, and Rs. 38,650 on conservancy as compared with Rs. 37,217.

The District Sanitary Boards met at each district head-quarters during the year, but no details regarding their proceedings have been furnished.

Madras.—Excluding the Presidency Town, the estimated income of the 58 municipalities in Madras in 1897 was Rs. 32,28,120, or about a lakh less than in the previous year. In spite of the diminution in their resources there was a very large increase in the sanitary allotment, which rose from 48·1 per cent. of the income to 63·6 per cent. ; the actual sum being Rs. 20,52,273, about four-and-a-half lakhs in excess of the allotment in 1896.

The actual expenditure, during the nine months ending on the 31st December 1897, was Rs. 11,37.397, including Rs. 4,07,095 on water-supply, Rs. 4,63,861 on conservancy, and Rs. 1,63,353 on the improvement of sites. The total expenditure was more than half the allotment, and the Sanitary Commissioner considers this satisfactory.

The municipal income of the Presidency Town was Rs. 14,42,070, and a sum of Rs. 19,04,424 was allotted to sanitation. This large sum, however, includes the money to be spent on water-supply and drainage works ; and the actual expenditure during the nine months was Rs. 4,55,332, including Rs. 2,38,068 on conservancy.

The Sanitary Engineer furnishes a concise table showing exactly the work which has been accomplished and what remains to be done in the fifty-eight municipal towns. In nine towns water-supply schemes have been completed, against three into which drainage projects have been introduced. Three water-supply schemes are in progress, five are in abeyance, seven are under consideration, and 12 surveys have been made but schemes have not yet been prepared. Four drainage schemes are in abeyance and two are being considered. Twenty-two towns have not been surveyed for the preparation of water-supply schemes, and 33 remain to be surveyed for drainage.

The water-supply works at Conjeeveram were completed in July 1897, and those at Kurnool in the following October. The work at Conjeeveram was less costly than had been anticipated, and it is proposed to devote the savings to fencing-in the pumping station, the construction of a service reservoir, and the extension of pipe-lines in the town.

The new works at Kurnool are designed to supply 15 gallons per head *per diem* to a population of 30,000. The water is pumped from the Kurnool-Cuddapah canal to a storage reservoir, sufficiently highly placed to command the town. From the storage reservoir the water passes to four filters together capable of filtering 450,000 gallons in the 24 hours, and from the filters to a clear-water reservoir, whence it is distributed to the town in iron pipes. To avoid interruption in the supply, a second pumping engine is in reserve, and the storage reservoir is capable of holding fifteen days' supply, so that the canal can be closed annually for repairs. In the town there are 46 public fountains and 13 hydrants.

The total income of the district boards was Rs. 79,10,730, about Rs. 57,000 less than in 1896, and the allotment for sanitary purposes was 8·4 per cent. of the income in both years. During the nine months of the financial year, 58·3 per cent. of the allotment was actually spent, including Rs. 2,48,065 on conservancy.

The Sanitary Commissioner points out the difficulty that must exist in dealing with epidemics in rural areas in the absence of any one capable of directing the measures that ought to be taken ; but a draft bill, which, it may be hoped, will strengthen the hands of

local authorities and enable them to appoint a sufficient staff to secure sanitary conditions by legal measures, has been circulated to those concerned for criticism.

Although alterations in the *personnel* took place during the year, the Board continued to work under the constitution framed by the Local Government in 1896. The Board was consulted by Government regarding rules regulating the formation of towns in the vicinity of railway stations and formulated a set of rules which might be usefully applied in, or modified to suit, other provinces. The Board scrutinised the plans and estimates for 185 sanitary projects, aggregating in value nearly twelve lakhs of rupees, of which 54 were for municipalities and 131 for local fund boards.

Coorg.—Besides the construction of drains in Somvarpet and a preliminary survey of Virajendrapet, no sanitary work appears to have been completed in any of the small towns in Coorg.

The Board met three times during the year, and among other matters discussed the following :—

(1) The heavy mortality among coolies going to and from the province. The cooly shelters, three of which have been opened and have proved most useful, have not served to check heavy mortality, and, although it was pointed out that many of the poor who died were beggars and were not looking for work, the Civil Surgeon considered that a simple labour law, providing for the licensing of labour contractors, the medical examination of coolies, the unfit being returned to their homes, and the treatment in hospital of those who become sick, was required. After discussion, however, the matter was allowed to drop.

(2) Measures to be taken against the invasion of plague. A series of simple rules drawn up by the Civil Surgeon were distributed for the guidance of the public.

(3) The excessive mortality in April, May, June and July. This was ascribed to malarial fevers, and a set of simple rules dealing with the personal prophylaxis and treatment of such fevers was circulated among the people.

Bombay.—Excluding Bombay City, the total income of the 167 municipalities in the Presidency in 1896-97 was Rs. 58,92,572, against Rs. 55,22,074 in the previous year. The sanitary allotment was 57·21 per cent. of the total income, or Rs. 33,71,008, and 84·84 per cent. of this sum was actually spent, as follows :—Rs. 9,07,896 on water-supply, against Rs. 6,47,329 in the previous year ; Rs. 14,77,597 on conservancy, against Rs. 11,06,662 ; and Rs. 1,71,085 on improvement of sites, against Rs. 2,22,905. Owing to the famine and the presence of plague but little progress was made on large schemes of sanitary improvement, but the towns received such a thorough cleansing that their condition is probable purer than it has been at any previous period of their history. If this improvement is maintained, much will be gained even if, as is to be feared, some of the larger schemes are deferred for want of the funds, which have been devoted to precautions against the invasion of plague. It will be gathered, however, from the following short notes on projects of sanitary improvement recently completed, in progress, or in contemplation in some of the towns, that municipal committees can often evade the prosecution of schemes of sanitation without pleading poverty.

Ahmedabad is an exception to the general rule, on account of the foresight and energy of the Honourable Mr. Runchorlal Chotalal, whom the townspeople are fortunate in having as the president of the municipal committee. This gentleman has been able to force through the committee schemes for water-supply and drainage. The water is, as usual, thoroughly appreciated by the people, and the demand has become so great that an extra pumping engine has been ordered.

At Ahmednagar, a scheme for supplying water to about one-third of the town has been completed ; and a project on similar lines for the supply of the rest of the town has been drawn up, but its execution depends on the construction of the Kapurwadi tank which, undertaken as a famine work, has only been one-fourth complete.

At Dhulia, the water-supply project was completed.

At Shikarpur, the municipality have shelved a small scheme for water-supply, preferring to rely on wells ; and every year new ones are sunk in the sewage-sodden subsoil, mostly in the floors of the houses, or in the small enclosures where cattle are kept.

At Sukkur, there is now a fairly good supply of water derived from tunnels driven in the rocky bed of the Indus. The water is pumped by a pair of engines to iron tanks

on a small hill, and is thence distributed by iron pipes to cisterns and stand-posts in the town.

At Surat, the water-works are nearly finished. The water is pumped from covered wells, sunk in the bed of the river Tapti, to steel tanks raised on towers, whence it is supplied to the city by gravitation. It is noted that, although the influence of the tide affects the level of the river much higher up than the head-works, the quality of the water is not affected.

At Yeola, the water-works, which were being carried out by the Public Works Department, were at a standstill on account of the non-arrival of pipes and engines ordered from England a year before.

At Ahmedabad, a drainage scheme, drawn up by Mr. Baldwin Latham, has been applied to a section of about one-fifth of the city, and has proved so satisfactory that it is about to be extended to the rest of the city. The sewage farm continues to be badly managed, but the municipal committee have acquired 300 acres of land about three miles away from the town, where it is hoped that sewage farming, as carried on at Karachi, will prove a success.

Karachi is another town in which the *personnel* of the committee and executive has secured progress in sanitation. The drainage scheme on the Shone system has been completed, and, the difficulties encountered on account of the height of the subsoil water having been overcome, is entirely satisfactory ; house connections are being rapidly made, and it only remains to extend the system to the cantonment. The sewage is utilized without nuisance and profitably, on a broad-irrigation farm. The amount of water brought into the town of Karachi has rendered it unhealthy, but it is hoped at once to diminish this evil, and to check waste by the imposition of a water-rate.

At Poona, where schemes for water-supply and sewerage have been pressed on the committee for years, no permanent improvement has as yet been effected. The Sanitary Board advised some check being placed on the waste of water in the *sadar bazar*, where the dampness of the soil, due to the urgent need for drainage, is a cause of sickness.

Sholapur town is at present drained chiefly by open channels, which are such a serious nuisance that the committee have been convinced of the necessity to substitute pipe sewers, and a scheme has been prepared by the Public Works Department.

At Sukkur, a specially appointed engineer has drawn up an excellent and economical scheme of drainage for the municipality, but the committee are hesitating between it and an extension of their present drains, which are described as elongated cess-pools.

The income of the various district funds rose from Rs. 40,05,823 in 1895-96 to Rs. 41,45,747 ; the sanitary allotment from Rs. 6,85,851 to Rs. 8,64,063, and the actual expenditure from Rs. 4,71,536 to Rs. 5,16,221.

The Bombay Village Sanitation Act was introduced into 62 villages during the year, raising the total in which it is in force to 282.

The constitution of the Board remained unchanged. The number of meetings is not stated, but much useful work was done in connection with the projects above referred to, and with schemes for the water-supply, drainage or improvement of the towns of Godhra, Dakor, Malegaon, Gadag, Tirkhundi, Khed, &c.

The Board reiterate their opinion that the cause of sanitation will be furthered by the judicious reward of the few influential men who use their position to overcome the opposition of their fellows to schemes of sanitary improvement.

Burma.—The aggregate income of the towns and districts in Upper and Lower Burma fell from Rs. 71,10,986 in 1896 to Rs. 64,91,740, and the proportion of the total set aside for sanitary purposes fell from nearly 35 to a little over 33 per cent. The actual expenditure was Rs. 21,50,918, distributed as follows :—On water-supply Rs. 2,41,137; on drainage Rs. 1,19,799 ; on conservancy Rs. 8,12,295 ; and on other sanitary works Rs. 9,77,687. As compared with 1896, there was a total decrease in expenditure of about three lakhs of rupees, mainly attributable to reduction of the sums spent on water-supply, for a decrease of two lakhs and forty thousand rupees under the heading " Drainage " was almost balanced by an increase of two lakhs and thirty-eight thousand spent on conservancy, and the sums spent on other sanitary works were approximately equal in the two years. As Colonel Sinclair remarks, " Considering the urgent need of sanitary reforms in the " majority of the towns, the amount spent on water-supply, drainage and conservancy is " very inadequate."

No new scheme was undertaken during the year, and very little practical action

in improving existing projects. In Rangoon the question of improving the water-supply is becoming yearly more urgent ; not only is the quantity certain to be seriously deficient in a year of scanty rainfall, but the catchment areas of the Victoria and Royal Lakes are subject to dangerous pollution. The Thamaing water extension scheme, which provides for a reservoir of a storage capacity of 5,827 million gallons, has been prepared, and is estimated to cost Rs. 20,00,000 ; this, with the existing supply from the Victoria Lake, it is hoped, would suffice for the wants of Rangoon for nearly sixty years to come. This project has been postponed pending a consideration of a scheme to obtain supplies from artesian wells, but the municipal committee, after a careful examination of the matter, have definitely decided that artesian wells are not suitable as a source of public water-supply in Rangoon. After the success which attended their somewhat adventurous embarkation on a sewerage scheme, it is astonishing that the municipality cannot come to some decision regarding the provision of a water-supply.

The Shone system of sewage disposal worked admirably without a hitch, and satisfaction with the working is growing from year to year. During the year 861,091,00 gallons of sewage were disposed of at a cost of little more than one anna-and-a-half per 1,000 gallons.

An interesting experiment in street-paving was made in the substitution of wood-paving for stone metal in a portion of one of the busiest streets in the town. The wood-paving has, so far, been entirely satisfactory, and a further stretch has been laid down.

At Moulmein, money was set aside for plans and estimates for a water-supply scheme, but no progress has been made pending the result of some well-boring experiments which, it is believed, will materially lessen the cost of the project.

At Bassein, also, tube-wells are being considered as a source of water-supply.

At Mandalay, the supply of water is still obtained from wells, from the moat, and from the Irrawaddy. The scheme to obtain a public supply from the river has been abandoned owing to engineering difficulties. A night-conservancy project has meanwhile ousted schemes of water-supply from the attention of the municipal committee, and a loan of 4½ lakhs was provided by Government for conservancy works ; but, at the last moment, the committee have fallen into doubt regarding the efficiency of their conservancy scheme, and have decided to apply it on a small scale in a few blocks of the town before committing themselves to heavy expenditure.

At Prome, a new filtration scheme is under consideration of the committee ; the unfiltered water, as now supplied, has been pronounced bad and unfit for use.

The village sanitary rules, issued in 1895, are reported to have worked well, and to have led in many cases to improvements in drainage and conservancy. In December 1897, a permanent sanitary record was introduced for use in towns and villages, which, it is hoped, will still further stimulate interest in rural sanitation.

The number of meetings of the Sanitary Board is not stated, and the Board were still occupied with the scrutiny of preliminary survey maps prepared for municipal towns. A sanitary engineer was appointed in January 1898 ; but the Sanitary Board's relation to him seems to be limited to the privilege of consulting him.

General Remarks.

International Conference at Venice.—The Government of India were represented at the International Conference, that sat at Venice from the 16th of February to the 19th March 1897, by their Sanitary Commissioner, then Surgeon-Major-General James Cleghorn, and by Surgeon-Colonel Richardson, who had recently retired from the office of Inspector-General of Civil Hospitals in the North-Western Provinces and Oudh.

The result of the deliberations of the Conference was the promulgation of the International Sanitary Convention of Venice of 1897, a series of regulations designed to prevent the spread of plague with the least amount of inconvenience to the public and to commerce, which in the opinion of the delegates was compatible with safety.

The Red Sea Pilgrim Traffic.—The Haj of 1897 began upon the 11th of May, but the assembly of pilgrims was much smaller than usual, the total number being only about

two-thirds that of the previous year. Several causes contributed to this result. In the first place, the Haj of 1896 was a Haj-i-Akbar, and it is the rule for the succeeding pilgrimage to be a small one. The Græco-Turkish war, it is stated, had the effect of preventing pilgrims leaving the belligerent countries. But the chief reason was the presence of plague in India, and the alarm experienced in consequence by European Governments, lest the Hejaz should be infected and become a centre of dissemination by returning pilgrims. It was feared in India that, unless steps were taken to allay the alarm in European countries, stringent measures would be directed against arrivals from India ; and, in spite of their reluctance to issue any orders which would interfere in any way with the religious observances of the people, the Government of India prohibited the departure after the 1st February from Bombay and Karachi of pilgrim ships. At the same time every effort was made to explain to the public the situation of affairs, so that intending pilgrims might be persuaded to defer their pilgrimage. As Calcutta and Madras were free from plague, it was made known that pilgrims might start from these ports, and the local authorities were warned to be prepared for an influx of pilgrims.

There was, of course, a danger lest pilgrims who had already assembled in Bombay might carry the plague with them to Calcutta and Madras, and to guard against this, instructions were given to dissuade pilgrims, who had already arrived in Bombay for the purpose of embarking, from seeking another port. Arrangements were made for the preliminary detention in segregation in Bombay of those who insisted upon going to Calcutta or Madras, and it was suggested to the authorities at Calcutta and Madras that they should detain such intending pilgrims, under strict medical supervision, in camps at a distance from the ports.

But the authorities in Madras and Bengal and many public bodies in those provinces did not think that these precautions were adequate, so that on the 16th of February the Government of India issued a notification under the Epidemic Diseases Act forbidding all persons resident in Bombay or Sind, including those who had entered these provinces on their way to the Hejaz, embarking at any port in British India for the purpose of proceeding to the Hejaz.

On the 20th of February, in consequence of a communication from Her Majesty's Secretary of State, a further notification was issued, suspending the pilgrimage from India for that season. Intending pilgrims, after suitable precautions had been taken, were sent to their homes at the expense of Government. About one hundred and fifty Central Asian pilgrims begged to be allowed to remain in India until the next season, and this was allowed. Such of the indigent as wished to go back to their homes in Central Asia were furnished with funds for the purpose and certificates showing the dates on which they had left infected places.

But directly one Haj ends another begins ; and poor pilgrims leave India for the Red Sea littoral in the autumn, before the steamship fares are raised in anticipation of the main body of intending Hajis. Before, therefore, orders restricting and finally forbidding the pilgrimage from India were issued a good number of pilgrims had already left India. Between the 1st of October and the 1st February seven steamers had left Bombay, conveying a total of 4,200 pilgrims. One steamer left Calcutta on the 21st January with 60 pilgrims. No pilgrims sailed from Madras.

Among the pilgrims who left Bombay, there were in all only 13 deaths on the voyage to Camaran, but two of the deaths were due to plague. These two deaths occurred on the S.S. *Pekin*, which left Bombay on the 28th December 1896 with 1,045 pilgrims on board. No other case occurred among the *Pekin's* passengers, or among the passengers of any other steamer, either on the voyage or at the quarantine station at Camaran.

The Quarantine Station at Camaran.—The quarantine station at Camaran was opened for the season for the reception of pilgrims on the 6th December 1896. Thirty vessels arrived during the season and brought 14,210 pilgrims, including 2,493 natives of India and 327 Afghans. A quarantine of ten days was, as usual, imposed upon arrivals from Indian ports ; but on the 8th of February orders were received from Constantinople increasing the quarantine for Indian ships in ordinary cases from ten days to fifteen, and fixing a period of twenty days for any vessel on which plague had occurred. There was no case of plague or cholera among the pilgrims at Camaran, and there were only 15 deaths among them altogether.

Improvements in the sanitation of Camaran were being carried out, which, when completed, will promote the health and comfort of the pilgrims detained there. During the season of 1897 condensed water was issued for the first time to the pilgrims, who

expressed their strong approval of the quality of the water. The condenser is capable of producing 80 tons of water a day; pipes are laid down to all the camps; and in 1897 every pilgrim was given ten litres of the water daily free of charge. An ice machine was also in operation, but no ice was issued to the pilgrims. Two disinfecting machines were taken into use.

The Return of the Pilgrims.—Although by the time the pilgrims were due to return plague had for the time greatly abated in Bombay, there was, of course, a great danger in allowing a large number of poor strangers to go into the town. Arrangements were accordingly made to prevent the mixing with the townspeople of the returning pilgrims, by taking them direct from the ship to the railway station and sending them in batches by special trains to their destinations, the local authorities concerned being advised of the despatch of each train. Such of the pilgrims as could not afford to pay for them were given tickets gratis.

On the 10th of June the Consul at Jeddah telegraphed that plague had broken out there. The Government of India then directed the Governments of Bombay and Bengal to enforce the regulations prescribed by the Convention of Venice against arrivals from the Hejaz, and special instructions were given for the disinfection of ships on which cases of plague might have occurred. Happily no case occurred among the returning pilgrims.

Four steamers arrived in Bombay with a total of 2,519 returning pilgrims on board. Only 20 deaths occurred on these vessels during the voyage to Bombay. Two of the steamers arrived at Bombay on the 10th June, and one of these, the *Pekin*, had on board over 400 pilgrims, whose destination was Calcutta. After landing the pilgrims for Bombay, the *Pekin* left for Calcutta, and 443 pilgrims were disembarked at Diamond Harbour. Three deaths occurred among the *Pekin's* pilgrims—one from phthisis and two from chronic diarrhœa, apparently on the voyage from Bombay to Calcutta. Two of the steamers arrived at Bombay after the Hejaz had become infected with plague, and the effects of the pilgrims on these vessels were disinfected prior to the despatch of their owners to their homes.

Anti-plague inoculation.—Extensive trial has been made of the inoculation with different serums for the cure of plague; and the preventive inoculation devised by M. Haffkine has been largely used in very many parts of the country. As, however, it is understood that anti-plague inoculation is one of the principal subjects engaging the attention of the members of the Indian Plague Commission, any criticism of the results hitherto obtained would at present be out of place here. Suffice it to say that, in view of the hopeful results which were obtained in the early experiments, every endeavour has been used by Government, not only to place M. Haffkine's preventive inoculation within the reach of those exposed to the infection of plague, but to encourage such persons to avail themselves of the protection.

Researches by the Special Assistant.—Brigade-Surgeon-Lieutenant-Colonel D. D. Cunningham had to leave India for Europe seriously ill in the end of March. During the first two months of the year he continued his researches into the physiological action of cobra venom, and the results of his work have been published in Part XI. of the Scientific Memoirs of Medical Officers of the Army of India.

The Etiology of Malarial Fever.—Until recently, our conception of the theory of the propagation of malarial fevers by the parasite discovered by Laveran was limited by the fact that no one had been able to discover the organism in external nature; and the difficulties surrounding the subject were so great that this discovery seemed to be almost hopeless. In 1894, however, Dr. Patrick Manson stated in a definite way a theory that the parasites are capable of transference to mosquitoes feeding on the blood of infected persons.* The belief that malarial fever was in some way connected with mosquitoes was not a new one; indeed, it appears that a connection between insects and malarial fever was suspected before the beginning of the Christian era.† In modern times a theory of the conveyance of malarial infection by mosquitoes existed in the United States, but seems to have remained unknown in Europe; and even the suggestion made

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* British Medical Journal, 1894, Volume II, page 1306.

† *See* paper by Dr. George H. F. Nuttall, in the Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, 14th February 1899, and following numbers.

more than once by Laveran himself,* that possibly mosquitoes played a part in the propagation of paludism as they do in filariasis, did not attract attention. It was not until the publication of Dr. Manson's paper on the subject that the minds of British observers, at any rate, were turned seriously to the mosquito as a possible intermediate host.

In 1895 Surgeon-Major Ronald Ross, of the Indian Medical Service, began the experimental study of the subject in India ; but for more than two years, during which he fed vast numbers of mosquitoes on persons suffering from malarial fever, he failed to obtain any conclusive evidence in favour of Manson's hypothesis.

Meanwhile, however, belief in the connection between malaria and mosquitoes was gaining ground, and it is of interest to quote the remarks of Dr. Robert Koch, who studied the subject in German East Africa :—

"With regard to the method of the origin of tropical malaria, I have arrived at "no certain conclusions. One cannot as yet go beyond conjectures. But the number "of possibilities which may be discussed in this regard are now with increasing knowledge "of the actual nature of malaria, being continuously limited, and there now remain, so far "as tropical malaria is concerned, only two agents for the conveyance of infection which "need be seriously considered. These are drinking-water and mosquitoes. The more I "study this disease, the more I incline to the opinion that the latter is the chief, and "probably the only factor. Wherever one turns, one finds a local and a seasonal "relationship between the existence of tropical malaria and the presence of mosquitoes. "On the coast there are a few places which are regarded as free from malaria ; one of them "is the island of Chole, which lies at the southern extremity of the large island of Mafia. "I have visited this island, which in former times was used as a sanitarium by the Zanzibar "Arabs. It is the only place on the coast where I was able to sleep without mosquito-"curtains. Among mountains malaria stops exactly where there are no longer any "mosquitoes. In the interiors of countries malaria diminishes where mosquitoes "diminish. At the times of the year when mosquitoes abound malarial fevers are most "frequent.

"I am most strengthened in my conviction by the analogy of malaria with Texas "fever and other tropical diseases of men and animals, in which the parasites are found in "the blood exclusively. In all these diseases the infection is carried by blood-sucking "insects, not indeed that the insect carries the infectious matter direct from the blood of "one animal to that of another, but the parasite goes through further developmental stages "in the insect, passes into the eggs and into the young insects, and is by them carried to "the proper host. In this or some similar way I think the mosquito plays its part in "regard to tropical malaria."†

In August 1897, Surgeon-Major Ross's perseverance was at last rewarded. He observed in the stomach of a particular kind of mosquito, fed on the blood of a person suffering from malarial fever, certain pigmented cells. From the resemblance of the pigment in those cells to that found in the organisms associated with malaria, he was led to hope that he had found an extra-corporeal development of the latter.

Major Ross' Discovery.—In February 1898, Surgeon-Major Ross was placed on special duty under the Sanitary Commissioner with the Government of India for the investigation of the malarial problem and *kala-azar*, and was given the use of the laboratory of the Special Assistant to the Sanitary Commissioner in Calcutta.

Surgeon-Major Ross at once resumed the study of the pigmented cells. After some experiments attended by negative results, he found that the pigmented cells were almost always present in a particular variety of mosquito,—a mosquito capable of carrying *filaria nocturna*,—after it had been fed on sparrows infected with *proteosoma* Labbé, which is a parasite nearly akin to the parasites associated with malarial fever in man. After examining a very large number of such mosquitoes fed on infected birds, controlling his experiments by the examination of insects of the same variety fed on healthy birds, Surgeon-Major Ross satisfied himself that the pigmented cells are a developmental stage in the mosquito of the blood parasites of the infected birds. He was, however, able to trace the gradual growth and development of the cells in the insects.

Shortly after the mosquito has been fed on the infected blood, the cells begin to appear,

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* Du Paludisme et de son Hématozoaire, Paris, 1891, page 147, and again on page 60 of the Volume on Paludisme in M. Léauté's Encyclopédie Scientifique des Aide-Mémoire, Paris, 1892.

† *Die Malaria in Deutsch-Ostafrica.* Arbeiten a. d. Kaiserlichen Gesundheitsamte, Volume XIV., page 299.

according to Ross, as small oval bodies containing pigment attached to the outer wall of the insect's stomach. These bodies rapidly increase in size, until after six days they reach a maximum of about 60 micromillimetres in diameter, and are protruded freely into the cœlum, or blood cavity, of the mosquito. Major Ross considers these bodies to be coccidia, and calls them *proteosoma* coccidia.

The next object was to discover the sporulation of the *proteosoma* coccidia; and Surgeon-Major Ross soon satisfied himself that there are two kinds of reproductive elements, (*a*) delicate thread-like bodies, and (*b*) large black spores.

And now the enquiry became of particular interest, for there was reason to suppose that the mode of infection of birds with proteosoma certainly, and the mystery of the infection of man with the organism of malaria probably, would be explained by the results of the next step in the investigation.

The results attained were somewhat unexpected, as Ross himself states. He discovered that the thread-like bodies have the faculty of entering and remaining in the large grape-like cells of the salivary gland of the mosquito. This gland lies near the head of the insect, and a duct runs from it to the extremity of the tongue or epipharynx, one of the stylets of the proboscis which is used by the mosquito to pierce the skin of its victim. Ross believes that the secretion of this gland is poured into the wound, its function being to prevent the contraction of the torn capillary vessels, and its effect the familiar irritation of the mosquito bite. His theory of infection was that the thread-like reproductive elements of the *proteosoma* coccidia, having accumulated in the gland, were carried out by its secretion into the blood of any creature on which the mosquito might feed. Once in the blood, *proteosoma* infection would be set up, provided the victim of the mosquito was a susceptible bird.

So far, this theory was supported only by the life-history of the *proteosoma*, and Ross next endeavoured to confirm his speculations by the direct infection of healthy birds. He fed a number of mosquitoes on birds infected with *proteosoma*, and, after keeping them for a week in order to allow time for the production by the *proteosoma* coccidia of the thread-like bodies, he fed the mosquitoes on birds which he had previously ascertained were free from *proteosoma* infection. The result was decisive. After a definite incubation period of from five to eight days, 80 per cent. of these birds became infected with what he describes as immense numbers of *proteosoma*. Most of the birds died and showed the characteristic black pigmentation in the liver and spleen. Major Ross states that *proteosoma* infection is found in only about 13·5 per cent. of the free sparrows which he examined in Calcutta, and then the parasites are far inferior in number to those in his experimental cases. He, therefore, considers that the fact that *proteosoma* infection is carried from a diseased to a healthy bird by mosquitoes has been placed by him beyond question.

Major Ross has not yet succeeded in extending these latter observations to human malaria, nor has he yet ascertained the function of the black spores; and work in both directions must be completed before the problem of the propagation of malarial fever can be said to be solved. He fears, moreover, that the task of finding the appropriate definite hosts for each of the different gymnosporidia will prove to be a hard one. Major Ross is, however, inclined to anticipate that the direct infection of the malarial germs through the suctorial apparatus of the mosquito will be found to be the only method of infection. If this is so, the prevention of malaria will depend upon the prevention of mosquito bites. This may not be so difficult as is supposed, because at any rate as regards several species, mosquitoes have a limited area of propagation, in barrels of water, puddles, and ditches, where small fish, which devour them greedily, cannot live.

Before the important subject of limiting the propagation of mosquitoes is considered, the species and habits of the insects which act as hosts to the parasites must be learned, and this work is now obtaining serious attention in many parts of the world. In the meantime it may be stated that there is good ground for the belief that the commoner species of mosquito cannot convey the organism of human malaria.

Confirmation and Application of Major Ross' Discovery.—Major Ross had not to wait long for the confirmation of his work. Dr. C. W. Daniels, of the British Guiana Medical Service, as a member of the Malaria Commission, was sent out to India that he might make himself acquainted with Major Ross' researches. In his report, about to be submitted by the direction of the Colonial Office to the Secretary of the Malaria Investigation Committee of the Royal Society, Dr. Daniels confirms Major Ross' discovery of the propagation of the *proteosoma* by mosquitoes.

In Italy, Professor Grassi and Drs. Bignami and Bastianelli, after receiving reports and

specimens from Major Ross, have published* their success in following the development of two of the parasites of human malaria in a species of mosquito (*Anopheles claviger*).

Kala-azar.—As the greater number of professional men who had studied *kala-azar* were of the opinion that it is a result of malarial infection, and as Captain Rogers had adduced some evidence in support of the belief that it is communicable in some way from man to man, it was believed that a study of *kala-azar* would throw some light on the problem of malarial infection. Accordingly, after he had succeeded in tracing infection by one of the so-called malarial parasites of birds from an infected bird through the mosquito to a healthy bird, Major Ross was deputed to Assam to investigate *kala-azar* on the spot. While this report is passing through the press, Major Ross has presented the outcome of his labours in a lengthy essay 'On the Nature of *Kala-Azar*.'

The questions which Major Ross set himself to solve were the following :—What is the nature of *kala-azar* ? If it is malarial, how can its communicability be explained ?

Major Ross begins his report with a description of the disease, which is a skilfully constructed mosaic of the opinions of the medical men who have had the most extended opportunities of studying its signs and symptoms directly. There are no prodromata. The onset of *kala-azar* is sudden ; the first symptom being fever which is introduced by a rigor or mere chilliness, is generally severe, may be continued, intermittent or remittent, and may last two or three weeks or even longer. This is succeeded by an apyrexial period lasting a week or two, to be followed by an attack of fever, similar to the first ; this in turn giving way to a fever-free period. There may be several alternations of fever and fever-free periods. In the meantime, the spleen always, and the liver in nearly every case, become enlarged and may be tender to the touch. Anæmia progresses with the illness, but varies in degree, extreme anæmia suggesting anchylostomiasis as a complication. Emaciation is progressive throughout.

Then follows a second stage characterised by extreme enlargement of the spleen and liver, and the persistence of a low form of fever which may last for months and may, or may not, be interrupted by attacks of high fever.

Dropsical conditions may arise ; bleeding of the nose is common ; and in some cases there is undoubted darkening of the skin.

The third stage is one of emaciation, during which the low fever disappears, the spleen and liver decrease in size, but emaciation and darkening of the skin persist, and weakness is extreme. Dysentery and diarrhœa are common intercurrent affections, and pneumonia may occur.

Death may take place during any of the stages—from high fever at the commencement of the illness, later from dysentery or diarrhœa or from exhaustion.

Shortly, then, the course of the disease may be divided into three stages ; the first characterised by recurrent attacks of high fever and rapid enlargement of the spleen and liver ; the second, by great enlargement of these organs and constant low fever ; and the third, by progressive emaciation.

The diagnosis of the disease in the first stage does not seem to be possible, as it does not differ from ordinary malarial fever ; in the second stage reliance is placed upon the failure to obtain good results from the administration of quinine, the history of several attacks among the family of the patient, and, probably, the great enlargement of the spleen and liver.

The pathology of the first stage is that of malarial fever ; but in the second stage Major Ross found that there were important differences from the conditions ordinarily held to be characteristic of malarial poisoning.

In cases in the second stage of *kala-azar* Major Ross found—

(*a*) that parasites were absent from the peripheral blood ;
(*b*) that parasites and generally black pigment were absent from blood taken during life from the spleen and liver ;
(*c*) that parasites and black pigment were absent from the spleen and liver in two out of seven autopsies ;
(*d*) that the temperature charts showed a fever apparently distinct from any of direct malarial origin ; but
(*e*) that yellow pigment was generally present in the liver.

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* Rendiconti della R. Accad. dei Lincei—*Ulteriori ricerche sul ciclo dei parassiti malarici umani nel corpo del zanzarone.* Rome, December 22nd, 1898.

The points wherein *kala-azar* resembled ordinary malarial fever then are :—

(1) The occurrence in malarious places.
(2) The similarity of the symptoms of the early stage, any difference being in degree not in kind.
(3) The presence of the yellow pigment.

The points of apparent difference are :—

(1) The high death-rate.
(2) The apparent inefficiency of quinine.
(3) Absence of parasites and melanin.
(4) The persistent low fever, which is not amenable to quinine.
(5) The fact of communicability, which Major Ross regards as proved.

Major Ross then proceeds to discuss the apparent differences between *kala-azar* and malarial fever. He points out that the mortality from *kala-azar* is probably overstated, because the belief in its fatality is so strong that if a case recovers, it is no longer classed as *kala-azar* ; and that the actual mortality is probably not greater than the mortality from the severe malarial fever of many Indian terais. The failure of quinine to control the disease in its initial stage may be due to its not having been administered in sufficient quantity and at the proper time ; moreover, quinine occasionally fails in undoubted cases of malarial infection.

The absence of parasites and melanin is a more serious matter, and if it is to be accepted that *kala-azar* is malarial fever, it becomes nccessary to show that parasites and melanin may be absent in later stages of malarial fever. This leads Major Ross into a most suggestive sketch of the essential conditions in an attack of malarial infection remaining untreated. It is explained that the vast amount of recent literature on the subject has the defect, so far as the present argument is concerned, of dealing almost exclusively with the condition of the blood and organs in Europeans who have received specific treatment for the disease.

When the indigenous inhabitant of a malarious place is attacked, the invasion of parasites is very rapid, the resistant energy of the system is brought into play, and if death does not occur from the violence of the fever, the parasites are repulsed, being either exterminated altogether, or their numbers reduced below the point of toleration when they produce no symptoms in the host, and would not be discovered by the microscope in his blood save accidentally. When they are not exterminated, the parasites remain in the blood without giving rise to any sign of their presence, until a chill or some other interfering circumstance lowers the powers of resistance in the system of the host. The parasites then increase in number, and a recrudescence of fever ensues. Another period of quiescence follows, and the struggle is renewed again and again, until the resisting powers of the system, which become stronger on each occasion on which they are called forth, are able to render the blood of the host uninhabitable by the parasites.

But while this contest is going on, congestion of the abdominal organs has been established, and pigment has been deposited in them, so that by the time the sufferer's system has overcome the parasites, his spleen and liver have become enlarged and are laden with black and yellow pigments. After the parasites have disappeared, the black pigment is eliminated, but the yellow irritating pigment remains behind.

Regarding the absence of parasites, Major Ross quotes Laveran,* who states that when cachectics have been free from fever for some time, the examination of their blood does not as a rule reveal the presence of parasites ; and he cites the experience of Dr. Daniels in British Guiana, where he found parasites much less frequently in cases of enlarged spleen than in early cases of malarial fever.

The low fever of the second stage of *kala-azar*, in Major Ross' opinion, is due to the enlargement of the abdominal organs, is, in fact, symptomatic, and as it does not depend upon the presence of the organisms of malaria, the temperature curve of the fever does not resemble a malarial curve, and quinine is without effect on the fever.

In *kala-azar* then, in the first stage, we have the signs and symptoms of severe malarial fever with the deposition of black and yellow pigments ; in the second stage, there is the elimination of the back pigment, while the yellow pigment is retained, and there is a low fever due to the enlargement of the spleen and liver ; in the third stage, that of cachexia, the elimination of the black pigment is continued.

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* Page 175, Traité du Paludisme, Paris, 1898.

Major Ross quotes Kelsch and Kiener's description of malarial fever, and shows that the conditions described by them as occurring in ordinary malarial fever are essentially the same as those occurring in *kala-azar*. He states, moreover, that *kala-azar* is practically the same as *kala-jwar* of the Darjeeling terai, and that a precisely similar fever occurs throughout India, especially in malarious localities.

The communicability of *kala-azar* does not of course differentiate it from malarial fever, if it is accepted that the latter is carried from man to man by suctorial insects. The spread of *kala-azar* in a village would depend upon the arrival in that village of a patient suffering from the disease, (in the early stage ?) and the presence there of the species of insect capable of carrying the parasite.

Perhaps the least satisfactory part of Major Ross' paper is his attempt to explain the cause of the special virulence of *kala-azar*. This must, he says, depend upon a special quality of the parasites or their occurrence in great numbers. He dismisses the first alternative without discussion, and suggests the explanation that an insect feeding upon the blood of a severely infected person would probably spread a severe form of infection.

Kala-azar then, according to Major Ross, is severe malarial fever, the distinctive later stages being due to the enlargement of the abdominal organs. The great mortality is due to the severity of the initial infection, aggravated by the conditions of life of the affected, and increased by the presence of anchylostoma and other intestinal parasites and the occurrence of dysentery in very many of the cases.

3196—6

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1897.

(*Surgeon Lieutenant-Colonel W. G. King.*)

Vital Statistics.

The census population of 1891 for the Presidency of Madras was 35,641,828.* Registration was conducted in areas inhabited by 32,638,243.* During the year, there was a net decrease of the population by 92,118 on account of emigration from the ports of the Presidency. The "natural increase" of the population amounted to 108,320 during 1897.

No change was made in the system of birth and death registration. A proposal was made by the Deputy Director of Agriculture (Board of Revenue), to utilize the birth registers throughout the rural areas for purpose of checking vaccination. This proposal was also made by me in my report on the re-organization of the Vaccination Department, dated 23rd October 1891, embodied in G.O., No. 1066 L., dated 9th May 1892. The details for the effecting of this desirable change were under discussion at the close of the year. In all municipalities this has been in operation with good results since 1895 (*vide* G.O., No. 1502 M., dated 19th October 1894). The system not only aids vaccination, but forms a good check upon false registration; as the necessity for vaccination entails in due course the verifying of each birth reported.

Births in Rural Areas.†—862,846 births were registered in rural areas. This affords a birth-rate of 28·3 per 1,000, against 29·5 of the previous year, and 27·3—the average of the preceding five years. Registration results are much vitiated in this Presidency in areas under zemindars, in consequence of the services of the village officials responsible for the statistics not being under the full control of the Revenue officers. The birth-rates for Muhammadans was 25·4, for Hindus 22·3, for Native Christians 23·7 per 1,000 of their respective populations in the Presidency including municipal towns. 104·0 boys were born against 100 girls. The previous year's percentage was 104·8.

A decrease of the birth-rate was registered in fifteen districts. There is no reason to regard this result as due to a falling off in the efficiency of registration having regard to the known increased care taken in this matter, and the fact that, although the total birth-rate is less than the previous year, it is above the average for the previous five years, and that no falling off had occurred in the death-rate. The decrease is doubtless due to a continuation of causes noted in paragraph 19 of the previous year's report, together with the influence of diminution of food supply in certain areas, and deferred marriages owing to the unfavourable state of agricultural prospects.

Births in Municipalities.—The total average birth-rate for the 59 municipalities in this Presidency was 34·4 per 1,000, against 36·1 of the previous year, and 34·0—the average of the five previous years. A decline of birth-rates occurred in 41 municipalities. The rates are so markedly incorrect in Chicacole, Berhampur, and Dindigul, that it is obvious that careless registration has had much to do with the result. The attention of the Chairmen of these Councils has been invited to this subject. In eight municipalities the birth-rate was over 40, in 14 over 35, in 20 over 30 per 1,000.

The following table contrasts the rates obtained during 1897 with those for the previous five years :—

Years.	Birth-rate per 1,000 of population.	Years.	Birth-rate per 1,000 of population.
1892	31·4	1895	35·3
1893	34·1	1896	36·1
1894	33·2	1897	34·4

* These figures include Europeans and Eurasians.

† Includes rural towns of 10,000 inhabitants and more, and excludes Municipal towns.

Taking into consideration the conditions suggested above, there is no reason to think there has been a falling off of efforts towards accurate registration, the total birth-rate being 0·4 above the average for the previous five years. If the three municipalities where it is suggested carelessness exists be excluded from the calculation, the birth-rate for the year shows an increase of 0·5 above the average for the previous five years.

Deaths in Rural Areas.—The total death-rate for the Presidency was 24·8 per 1,000, which is the highest recorded since 1891. This is 5·1 per 1,000 above the average for the preceding five years, and 4·8 above that for the preceding year. In 15 districts, the average for the five years and the rate for the preceding year were exceeded. The increased rates were most evident in the seven districts in which famine was officially recognised as existing. In Malabar and South Canara, where scarcity was experienced for a certain period by the poorer classes, but was not considered of such a type as to demand special aid from Government, the mortality also was above the average. In these districts, the death-rate under all diseases recognised by registration underwent an increase. In both, fevers were unusually severe. The rise in the total death-rate was, however, chiefly influenced by the large numbers of deaths registered under cholera and small-pox in Ganjám, and cholera in Malabar and Tanjore. The following table shows the death-rates and incidence of death causation during the last seven years :—

Years.	Death-rate per 1,000 of population.						
	Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other causes.	Total.
1891	2·8	1·2	7·3	0·8	0·3	9·0	21·4
1892	2·3	1·3	8·3	0·7	0·4	8·6	21·6
1893	0·9	0·8	7·6	0·5	0·3	8·4	18·5
1894	1·2	0·3	8·0	0·6	0·3	8·9	19·3
1895	0·6	0·2	8·2	0·5	0·3	9·2	19·0
1896	1·4	0·3	7·9	0·6	0·3	9·5	23·0
1897	4·4	0·7	9·0	1·0	0·3	9·4	24·8

94·2 women died against 100 men. Last year, the figures were 94·5 women against 100 men. The infantile death-rate per 1,000 of births was 164·5, against 156·9 of the previous year.

Deaths in Municipalities.—The total average death-rate for the 59 municipalities was 33·3 per 1,000, being an increase of 2·6 above the previous year, and 2·5 above the average for the five previous years. The infantile death-rate was 223·1 per 1,000 of births, against 232·9 per 1,000 of the previous year. The death-rate amongst adults of over 50 years of age was 61·8 per 1,000 of the population of that age, against 57·6 per 1,000 of the previous year.

Chief Diseases.

Cholera.—A total of 143,445 deaths from cholera were reported in the Presidency, being at the rate of 4·4 per 1,000 of the population, against 47,847 deaths of the last year, or 1·5 per 1,000 of the population. The mortality in Ganjám and Malabar was very heavy from this cause, namely, 15,553 and 27,533, respectively. In both districts the sanitary efforts made cannot be described as adequate, but, on the other hand, the predisposition of the population was increased by conditions of scarcity. Indeed, the medical officers of both districts maintain that diarrhœa of a character simulating cholera was due to the eating of unfit food by the people.

In municipalities the total deaths from cholera amounted to 10,258, or at the rate of 4·8 per 1,000 of the total population.

Although owing to inadequacy of staff not much can be done in this direction, all local authorities are fully aware of the importance of strict attention to the careful destruction of choleraic matter, and protection of water-supplies from contamination. The disinfection of water supplies, when small, by means of permanganate of potash, and, when large, by lime and alum, is freely practised. The latter process is so similar in its rationale to that secured by use of the clearing nut (the *strychnos potatorum*) that I have never heard of opposition to its employment. The red colour produced by the permanganate of potash, which is specially advised by Mr. Hankin, is occasionally objected to; but, on the whole, both the people and the medical officers regard its use favourably in most districts. Tables issued from this office allowing of quick calculation of quantities to be employed of these disinfectants, have been long in the hands of Certificated Sanitary Inspectors and medical subordinates.

Small-pox.—A total of 21,678 deaths from small-pox occurred in the Presidency—equivalent to a death-rate of 0·7 per 1,000.

Ganjám suffered most severely from this disease, no less than 14,515 deaths being registered under this head. The following extract from the District Medical and Sanitary Officer's report sufficiently explains this result, when combined with the fact that the people must have wandered from village to village in search of employment, during the early period of the famine:—

"The presence of distress in the district has no doubt had much to do with the widespread "prevalence of cholera and small-pox; but as regards the latter, I am of opinion that the small-"pox epidemic would not have assumed such proportions had vaccination been made compulsory "in this district. To assist the permanent staff six temporary probationary vaccinators were "employed for nine months.

* * * * *

"It must also be noticed that the customs of the Uriyas greatly tend to spread an outbreak "of small-pox. The infected rag and mats, &c., are collected and thrown into the open and the "soiled clothing, &c., washed in tanks used for drinking purposes, thus disseminating the disease. "Several instances have been brought to notice where the bodies of people dying of small-pox "have not been buried, but deposited on tank bunds or dry bed of tanks and other convenient spots. "This matter was brought to the Collector's notice and orders were issued to prevent this procedure. "I fear it will not be possible to entirely stop this custom, nor will small-pox be kept in check until "vaccination is made compulsory throughout the district. Zemindary villages are very dirty and the "Uriya people are very dirty in their habits, and there is very little control in a sanitary sense kept "over them."

Malabar, which so long headed the list, does not now exhibit the usual mortality from small-pox. The vaccination staff has been considerably increased, and much attention has been paid to perfecting the working of the department in this district. The result is apparently a steady diminution of the deaths from small-pox, from 12,068 in 1893 to 43 in 1897. Of course, this *post hoc propter hoc* argument is open to the criticism that a large number of the population are now really protected not by vaccination, but by previous attacks of small-pox. Time alone can, of course, prove which is the real factor. In the meantime, there is undoubtedly still much room for improvement of organization of the Vaccination Department in Malabar, to enable it to suit the local peculiarities of distribution of villages and residencies.

Fevers.—The total deaths from fever in the Presidency amounted to 292,292—equivalent to a rate of 9·0 per 1,000 of population, against 260,769, or 8·0 per 1,000 in the previous year. The excess deaths occurred in June and subsequent months. Up to that month, the mortality from this cause had been less than in the previous year. The comparative freedom in the early part of the year must be ascribed to the diminished soil moisture proving inimical to the propagation of the malarial germ, in consequence of failure of the north-east monsoon of the previous year: this was followed, on access of moisture with the south-west monsoon, in the presence of a population rendered susceptible to malaria owing to diminished food-supply, by a mortality greater than normal under this head.

Surgeon-Major Ross, with whom the study of malaria is a speciality, made several important advances towards the completion of proof of what has hitherto been a mere hypothesis as to the part borne by the mosquito in propagating malaria. He has been since placed on special duty under the Director-General.

In the Cuddapah district, the diminution of malarial fever noticed in the last year's report continued up to the month of April 1897. Up to this time, 2,119 lives had been saved when the average death-rate for the preceding five years is regarded, but, subsequent to this period, an increase in the fever incidence set in; so that at the end of the year there was an excess under this head when compared to the previous year, but still the rate was 1·5 below that for the five years' average. The influence of famine conditions doubtless aided this result.

During the year, the Sanitary Engineer's Department in the course of borings, preliminary to a drainage scheme for the Cuddapah town, showed that the soil rests upon a thick layer of clay, beneath which again is found the water derived from the numerous springs, which apparently flow beneath the town from the adjoining range of hills. This has been advanced as a satisfactory reason why a sub-soil drainage scheme should not be attempted side by side with the sewerage scheme. The argument, however, seems to me to assume a continuity of this clay layer which is not certain in nature, and has, as a matter of fact, been artificially disturbed all over the town by the digging of wells allowing the sub-soil water under pressure to rise above the clay, and to ignore the property of clay which, whilst not readily permitting the direct passage of water through it, nevertheless must, by capillary attraction of the soil above, yield vast quantities of moisture.

In the case of Kurnool town, which shows the very heavy increase in the death-rate of from 13·5 to 21·7 per 1,000, under this head, the probability is that the disturbance of the soil during the excavations for the water-works throughout the town has had much to do with the result ; as foreseen by me, would be the case (*vide* page 6 of my Inspection Note embodied in G.O., No. 480-M., 10th April 1894) irrespective of the increased susceptibility of the population owing to famine conditions.

Dysentery and Diarrhœa.—The death-rate under dysentery and diarrhœa was 1·2 per 1,000 of the population, against 0·7 per 1,000 of the previous year. The excess was contributed to by 13 districts, of which seven were formally recognized as suffering from famine, whilst in the others undoubtedly a considerable grade of distress was undergone :—

Anantapur,	Kurnool,	South Canara,
Bellary,	Madura,	Tinnevelly, and
Cuddapah,	Malabar,	Vizagapatam.
Ganjám,	Nellore,	
Gódávari,	North Arcot,	

In the following towns where the incidence was over 1·5 per 1,000 greater than in the former year, the explanation above given also applies :—

Anantapur,	Tellicherry,	Cuddalore,
Bellary,	Cochin,	Mangalore,
Adóni,	Nellore,	Máyavaram, and
Cocanada,	Ongole,	Bimlipatam.
Ellore,	Gudiyáttam,	
Kurnool,	Tirupati,	

The continued presence of diarrhœa and dysentery in Coonoor, combined with the high death-rate from general diseases, dictates the necessity for early action in reference to the water-supply of the town which, as I have shown in former reports, is subject to pollution. The municipality has now before it for consideration a sound water-supply scheme ; if it does not wish the fame of Coonoor as a sanitarium to pass away from it for ever, it will endeavour its best to finance it without delay.

Comparative statement of incidence of special diseases.—The following table contrasts the chief points discussed in this, and in the foregoing section, with reference to the Presidency as a whole, in a convenient form :—

	Birth-rate per 1,000 of the census population.	Death-rate per 1,000 of the census population.						
		Cholera.	Small-pox.	Fevers.	Dysentery and diarrhœa.	Injuries.	All other causes.	Total.
1892	25·1	2·3	1·3	8·3	1·0	0·3	9·0	22·3
1893	27·0	1·0	0·8	7·7	0·7	0·3	8·8	19·3
1894	27·7	1·3	0·3	8·0	0·7	0·4	9·3	20·0
1895	29·1	0·6	0·1	8·3	0·7	0·3	9·6	19·6
1896	29·9	1·5	0·3	8·0	0·7	0·3	9·8	20·6
1897	28·7	4·4	0·7	9·0	1·2	0·3	9·8	25·4

Sanitary Works.

Municipalities.—In conformity with the amended Municipal Act (Act No. IV of 1884 amended by Madras Act No. III of 1897) in certain municipalities having a total income of over Rs. 30,000, the question of employing Secretaries to aid the unpaid Chairmen has engaged a good deal of the attention of councils.

It remains to be seen whether the arrangement, which was a compromise for the original proposal of having paid Chairmen, will prove of advantage in administration. It would at least seem essential if the incumbents of the appointment are to be more useful than the old manager class of men, that they should be required to pass examinations in certain minor engineering subjects, and possess a certificate in sanitation. A further sequence of the introduction of the new Act has been a demand for issue of model forms for licenses for offensive or dangerous trades. These have been prepared, and will be issued to municipal councils shortly. As valuable additions have been made in the District Municipalities Act for regulating milk and food supplies, and conditions under which the opening of new water sources, burial grounds, &c., is permitted, there is every reason to hope that the demand, which has been quite spontaneous, represents a determination to meet the requirements in necessary sanitary matters with firmness.

The accompanying statement exhibits the expenditure on sanitary improvements during the year. In perusing this, it must be remembered that the period 1896–97 is for the whole official year, whereas that for 1897–98 is but for nine months of the year :—

	1896–97.		Rate per cent. of expenditure to total allotment.	1897–98.		Rate per cent. of expenditure to total amount.
	Amount sanctioned.	Amount expended.		Amount sanctioned.	Amount expended in nine months ending December 1897.	
	Rs.	Rs.		Rs.	Rs.	
For conservancy	5,82,010	5,52,307	94·9	6,50,524	4,63,861	71·3
For improvement of village or town sites.	2,96,941	2,67,875	90·2	2,78,375	1,63,353	58·7
For improvement of water-supply, cleansing, repairing, and construction of tanks and wells.	4,29,440	4,72,237	109·9	9,48,885	4,07,095	42·9
For sanitary arrangements during fairs and festivals.	36,950	35,314	95·6	13,760	10,085	73·2
For construction and repair of markets and slaughter-houses.	47,158	28,138	59·7	40,111	13,766	34·3
For other sanitary objects...	1,23,043	1,01,361	82·4	1,20,618	79,237	65·7
Total	15,15,542	14,57,232	96·2	20,52,273	11,37,397	55·4

Having regard to the proportion spent up to the end of the calendar year, there is little reason to believe that funds have been allowed to lie idle. The expenditure under conservancy, which amounted within the period stated to 71·3 per cent. of the allotment, shows that conservancy is conducted in municipalities with slightly increased vigour. No opportunity, in reporting during inspections as to the condition of municipalities, has been neglected by myself or Deputy to impress upon municipal councils the absolute necessity there is for improvement in this the A B C of sanitation. Similarly, in reviewing each proposed budget, the attention of Government has been invited to the necessity for improvements. As with most sanitary reforms in this country, some time has elapsed in securing the desired ends, but I think the statement of method of expenditure of funds shows that many councils now recognize their shortcomings in

this respect. Urgent reminders as to preparations for plague have doubtless also influenced results. One of the most difficult matters to bring home to councils has been the fact that with the capacity of plant at their disposal and the number of trips per cart feasible, it was impossible for them to do more than make very perfunctory attempts at removal of night-soil and rubbish. Curiously enough conviction on this point has always been much more easy with respect to rubbish removal than night-soil. The statement, however, shows that a large number of night-soil carts have been added this year to the municipal plant. Municipalities to the north of the Gódávari river form remarkable exceptions to this statement; they busy themselves in evolving amazing reasons why it is preferable to use open baskets borne by men or women, instead of employing night-soil carts.

In the reorganization of the staff also a satisfactory change has occurred. The effect of the attempt to furnish supervising staffs on the lines of quality instead of quantity is exhibited by the decrease of the uneducated class of "overseers" and peons, in favour of an increase in Sanitary Inspectors, all of whom, if newly appointed under G.O., No. 4-M., dated 4th January 1897, must possess qualifying certificates.

No advance beyond that reported last year has been made in respect to sewage farming. Sewage filtration continues to be satisfactorily practised at Vizagapatam and Vizianagram.

The "ærated household sewage filter," mentioned in my report for 1895, continued to work most satisfactorily at Bellary during the year; as it was animadverted upon by the Army Sanitary Commission, I have not sought to put it further into use. I may, however, state that it continued to discharge the sewage from the large household served, in a condition pure to sight and smell; at the top of the filter a thin layer of deposit formed, almost devoid of odour. The filter continued to work without a renewal of the material successfully for over fourteen months. The principle of filtration of sewage was also carried on at the Pushkaram festival at Bezwada, and at the Mahamagham festival at Kumbakónum. In the latter town, owing to absence of any sewerage system, pools of sewage forming suitable breeding grounds for masses of mosquitos are common in every lane. Grasping the principle of sewage filtration exhibited to them at the Maghamagham festival, under the superintendence of Surgeon-Captain Vickers, the council has sent, for approval as a temporary measure, a scheme for sewage filtration at various convenient parts of the town, united with disposal of the crude sewage upon suitable plots under cultivation. In the meantime, the sewage of a largely inhabited town is being disposed of satisfactorily by the temporary filter made on this occasion.

The rules for regulating the sanitary action of municipalities during cholera epidemics (G.O., No. 1536-M., dated 9th September 1896) continued to receive far less punctual observance than consistent with success in combating a disease where promptness of action is essential. The loop-hole given in the regulations that, with the consent of the Collector, the staff may be less than laid down in the rules, is freely utilized, with the effect of rendering results very indifferent. Where the rules have been promptly obeyed, their influence in saving life and arresting cholera epidemics is indubitable.

District Boards.

The advent of the amended Act for Local Fund areas has been foreshadowed, by the circulation of the draft Bill to all authorities for criticism and suggestions. As remarked in former years, until the hands of the Local Fund bodies are strengthened by an Act that will give them money and power for appointing sufficient staff, and for securing sanitary ends by legal measures, it is impossible to expect a very rapid rate of sanitary advance. One of the most glaring defects is the absence of a sanitary staff for employment during epidemics. Huge areas of the rural tracts are still unprovided with any one capable of directing measures during epidemics, and of even the small menial staffs that exist. The importance of the employment of Certificated Sanitary Inspectors for the purpose has been repeatedly brought by me to the notice of District Boards. But, as might be expected from their constitution, District Boards are slower than municipalities in recognising the desirability of early action. A lamentable instance of the want of an organization capable of dealing with epidemics, is exhibited in the fearful mortality that occurred in the districts of Malabar, Ganjám and Tanjore from cholera during the past year. Most District Boards have, in connection with reviews by this office on submission to Government of their budgets, now got this question before them, and certain of them have made proposals on the subject.

During the year, four Certificated Sanitary Inspectors were employed in Kistna, two in Trichinopoly, and one in Tinnevelly.

Nine villages were converted into unions during the year—making a total of 378 existing unions. This implies at least that in these villages some distinct efforts towards the more simple dictates of sanitation are being made.

The allotment for sanitation was 8·4 of the total estimated income, being the same as in the previous year. Under conservancy, the allotment underwent an increase. In the case of Malabar, South Canara and Ganjám, the allotments were particularly unsatisfactory as to amounts. Government has, in response to my opinion on the budgets, invited the attention of the Boards, but without avail. In the case of Malabar and South Canara, fixed local opinions exist as to there being no necessity for taking action—it being especially an article of faith that men who live for the greater part of their service on the east coast of the Presidency cannot understand the great advantages resulting from the habits of the people living in "Parambas," and their having independent water-supplies. That, however, sanitary supervision is just as necessary here as elsewhere, is proved by the following extract from the Annual Report by the District Medical and Sanitary Officer, Surgeon-Lieutenant-Colonel Wilkins :—

"During the monsoon, in addition to cholera, there was an epidemic of enteric fever in the town "and district, among the natives chiefly. There were 18 cases, in all, among the Europeans and "Eurasians. 128 cases were treated by myself and the medical subordinates in the district, and two "native qualified practitioners treated 15 cases. It is a mistaken idea to believe that natives have an "immunity against enteric fever. I have had under my care undoubted cases showing every "complication. In fact, from enquiry, I believe the disease is epidemic in parts of Malabar and its "prevalence greatly depends on the sub-soil water. It usually begins to show itself about the "middle of the rainy season, when the sub-soil water is almost on a level with the surrounding "ground, and it lasts for quite four months or longer, until the water sinks to 12 or 16 feet below "the surface. I attribute this chiefly to the practice here of having pits in the compounds for "latrines, as also in many cases, to the burying of the dead, among some classes, in the same "compound, and when one considers that these are all within 10 or 15 yards from the drinking-"water wells, it is not a matter of surprise that the disease shows itself in the rains and it is no "wonder then that enteric cholera and other water-borne diseases are constantly present in Malabar.'

Personal Proceedings.

On the 19th December 1896, I started upon a tour in the famine-affected districts and continued in camp without intermission till the 8th March 1897. During this time, I was engaged in passing from village to village, with the object of not only studying the condition of the people and the necessity for affording them relief in various doubtful areas, but of gathering data in respect to their normal food supply, and watching the influence of the famine rations. I found it necessary to advise Government that the famine rations C and D were unfit for purposes of labour, and represented that the B ration was the least that could be used with safety. In these contentions, I received the cordial support of the Famine Commissioner, Mr. W. J. H. LeFanu, an officer of exceptionally large famine experience. In offering this advice, I was perfectly well aware that my views would not coincide with those prevalent in other provinces. But a tour in the famine-affected districts of Bombay and study of methods in other provinces, showed me that the different wording and interpretation of the codes, and various items in the administration of relief, contributed to produce different results, under nominally the same conditions. It seems to me perfectly clear that when the lower grades of diets are considered, it is impossible to show that a native can live "in health and strength" upon any less than a European, when the amounts of nutriment are reduced proportionately for the respective weights of these races. It is equally impossible for him to live without vegetable diet—as the famine diets practically presuppose—without exhibiting symptoms of scurvy.

From a review of all attendant circumstances, I believe the adoption of the policy of giving a diet just sufficient for requirements, and yet not vitiated by the indubitable deficiency offered by the C diet, really proved a source of financial benefit, in that the enormous indirect charges incurred in other provinces were in Madras rendered unnecessary. At any rate, it served the required purpose of saving life in the midst of distress, that, at certain parts of the year, was as acute as during the famine of 1877, when many thousands lost their lives in spite of the practically unlimited expenditure of money in attempting to save them, after the error of scanty diet had been ascertained too late for effective action. I would add that the conclusions to which I invited the attention of Government were not founded upon mere theory ; but that wherever I went I took with me scales and weights, and daily undertook experiments with both cooked and uncooked food of the labouring classes and famine workers, &c., &c.

In March, I proceeded to Rajahmundry Jail for the purpose of investigating an epidemic of cholera which had occurred there. I returned on the 28th March to headquarters. On the 8th April, I proceeded to inspect the railway observation camps at Pódanúr and Arkonam. On my return, I was required by Government to proceed to Ennore, where unusual prevalence of fever had disabled the Salt and Abkárí Department staff, and there was doubt as to its nature and origin. It proved to be of the malarial type. From Ennore, I proceeded to the Coimbatore Jail, where also an epidemic of cholera had taken place. By the 21st April, I was again ordered to proceed to Rajahmundry Jail to investigate with the Surgeon-General certain matters in connection with the general ill-health of the prisoners. In the intervals of work, I had when at headquarters afforded my customary aid to the Professor of Hygiene, by undertaking the teaching of the Certificated Sanitary Inspectors' class by out-door demonstrations.

In June, I was detailed by Government to meet in Madras Drs. Lorans and Lawson, the latter in the function of Plague Commissioner. He was, unfortunately, unable to tell me precisely what date he would arrive, and when this took place, was incapable of fulfilling work, as he was laid up with fever. On his departure, I left for Coonoor with reference to inspection of certain grave-yards. I then proceeded to Cuddapah to meet Mr. Higham, who had been deputed by the Government of India to inspect famine works in this Presidency. I inspected with him the famine works at Cuddapah, and then proceeded to Adóni with him. Here I met the Famine Commissioner, and proceeded on tour with him till the 27th July. In August, I toured in the famine-affected districts of Bombay. In September, I inspected certain villages and famine works in the Adóni, Anantapur and Jammalamadugu taluks. In October, an imported case of plague having occurred in Madras, as soon as matters were arranged locally, I proceeded again to inspect the camps at Guntakal and Arkonam. In November, I proceeded to Berhampur with reference to the fixing of the boundaries of the cantonment, as a member of the military committee for this purpose. On my return, I investigated suspicious cases of plague that had been reported in the North Arcot district. These proved to be instances of anthrax in the human being, of which four instances in various localities in this Presidency have come to light during the present year. In December, I made a tour by road through certain of the famine-affected taluks in the Bellary district, with the object of ascertaining the condition of the villagers at the end of the administration of relief. Attendance upon the Famine Conference at Madras closed the year. There was thus no time to attend to routine of inspections of municipalities, and, this having been represented to Government, it determined that the demands of famine and plague should first receive my attention (G.O., No. 1545-L., Mis., dated 15th August 1897). However, matters connected with sanitation and vaccination were brought to notice of village and revenue authorities—more especially with regard to water-supplies—when inspecting villages.

During the year, I fulfilled 6,296 miles by road and rail, and was absent from head-quarters a total of 196 days. Irrespective of routine office work, which was heavy on account of famine and plague arrangements, I dealt with 143 papers referred to me by the Sanitary Board.

With reference to the continued presence of plague in the other parts of India, Government accepted my advice against any attempt at quarantine by land or sea for healthy persons or ships. This policy anticipated practically the line of action advised by the Venice Convention. The result has been the weaving of a system of "observation," effected by all local authorities and the Police, throughout the Presidency, in conjunction with special points of observation on railways. Although in practice there was no want of evidence that it was favoured by the element of chance, this system proved itself worthy of confidence during the only known instances of importation of plague during the year. A racing party that had visited Poona was affected. A case of plague from amongst them was taken from the train at Guntakal, and another at Arkonam. A third case underwent incubation in Madras whilst on the observation list. He died of the disease. In their eagerness for ascertaining the conditions in this—to them new—disease, a *post-mortem* was conducted by two medical officers ; one had an abrasion in his hand, and was duly affected with symptoms indistinguishable from plague ; an attendant pricked his hand during the *post-mortem*, and died of this disease. This menial absconded from the hospital, but was luckily traced by the then Health Officer of Madras—Dr. Cook. Under the system of observation in force, the whole of the persons connected with the outbreak were readily traced and carefully supervised. In the various steps requisite, I was in close communication with the President of the Municipality of Madras, who was prompt and decisive in all arrangements made. At Guntakal and Arkonam, every possible precaution was taken to prevent further spread from these cases intercepted there.

The man received at Arkonam ultimately recovered. However much, therefore, Madras may have been favoured by climatic conditions inimical to the spread of the plague microbe, and by amount of passenger traffic with provinces that had been affected being limited, there can, I think, be no shadow of doubt that the sanitary measures put in force by Government did, in these instances, effectually prevent what might reasonably have been looked for, namely, the epidemic spread of plague from imported cases. For example, had not, under the "observation system," there been available lists of all persons connected with this infected party, it would not have been possible, as was actually done, to ascertain that each individual had passed safely throughout the ten days incubation period. Whatever there may be in store for this Presidency in the future, it is, humanly speaking, certain that the measures adopted on this occasion did, at least, defer its fate. Whilst fully admitting the conditions I have noted as favouring this Presidency, I cannot but think that it is a matter for content that safety has been attained through so many months of doubt, without the discomforts to the public and losses to trade incidental to a system of "land quarantine," which, I was strongly urged by the Government of India Plague Commissioner to believe, was the only safe course to pursue.

The principle of using Mons. Haffkine's inoculation as a prophylactic measure was early recognized by Government as likely to be of much utility, and since October 1897, a reserve of his "Vaccine" has been kept in store, with necessary syringes for instant issue, in the event of an outbreak—as an addition to ordinary sanitary precautions.

Sanitary Engineering (1897).

The Sanitary Engineer visited 10 towns, and the Assistant Engineer 8, against 13 and 11, respectively, in 1896. Some of these towns were visited more than once. During the year surveys, either for water-supply or drainage, were completed for 2 municipalities, and were in progress in one municipality as against 7 in 1896, and additional levels for water-supply were taken for 2 municipalities. Water-supply schemes for Negapatam and Coonoor, estimated to cost Rs. 9,89,680 and Rs. 1,13,800, respectively, and drainage schemes for Cuddapah and Tanjore (portion), at an estimated cost of Rs. 5,40,000 and Rs. 33,440, respectively, were submitted to the Sanitary Board during the year. Preliminary reports and alternative estimates amounting to Rs. 1,70,000 and Rs. 1,28,000 for the water-supply of Ellore, and estimates for the extension of the infiltration gallery at Cuddapah, and extensions of water-supply at Conjeeveram and Trichinopoly were also submitted. The estimate for Cocanada water-works was also revised. At the request of the Kumbakonam Municipality, a rough estimate amounting to Rs. 25,000 for the sewerage of a portion of the town called the Putnul block was furnished. The Municipal Council of Madura was furnished with plans, and an estimate amounting to Rs. 5,200 for the extension of pipe lines to Teppakolam. At the request of the Sanitary Board plans and estimates amounting to Rs. 1,031 and Rs. 1,293 were prepared for the improvement of the Penta main drain in Tirupati. Schedules and specifications for the execution of water works in Cocanada, Tirupati, and Vizagapatam were prepared and furnished to the Public Works Department. The water-supply works for the towns of Kurnool and Conjeeveram which were in progress during the previous year were completed during the year, and handed over to the Municipal Councils concerned. The services of the Assistant Sanitary Engineer to Government were temporarily placed at the disposal of the Pudukkottai Durbar, for the preparation of a scheme for the improvement of the water-supply of the town. Twelve new type designs for various sanitary works were prepared during the year, and were approved of by the Sanitary Board. Advice was given to the Sanitary Board in respect to 46 municipal and 68 local fund schemes.

The works at Madura, Kurnool, Dindul, Trichinopoly, Tanjore and Adoni were inspected by the Sanitary Engineer during the year. The Inspector of Steam-boilers and Prime-movers visited the pumping stations at Cuddapah, Trichinopoly, Tanjore, Madura, Dindigul and Conjeeveram, and made a complete inspection of the whole of the engines, boilers and pumps. Detailed reports were forwarded to the councils concerned, with a request to carry out the necessary repairs.

Sanitary Board.—The Sanitary Board continued to work under the constitution framed by the Local Government in 1896. During 1897 several water-supply and drainage schemes were examined and submitted to Government by the Board.

The question of bacteriological investigation engaged the attention of Government during the year, and the Sanitary Board was asked for information as to the amount of

work that would be required of a bacteriologist by the Board in connection with actual local requirements apart from general and theoretical researches. The Sanitary Board endorsed the views of the Sanitary Commissioner who entered very fully into the nature and scope of the work that a bacteriologist might be expected to undertake. It was pointed out that the labours of such an officer would cover a wide field, and would embrace the bacteriological examination of all suspected sources of contamination from which disease, affecting the population, might arise, so as to identify the source and the nature of the poison. A bacteriologist might also by preliminary investigations determine the value of certain classes of sanitary works before they were undertaken, and thus prevent mistakes and save useless outlay. The Government arrived at the conclusion from the consideration of these and other opinions that there was a large scope for a bacteriologist in this Presidency, and advised the Government of India accordingly.

The Board was also consulted by Government regarding rules regulating the formation of towns in the vicinity of railway stations, and they submitted a set of rules for adoption. The Board also scrutinized during the year plans and estimates for 185 sanitary works, of which 54 were for municipalities and 131 for Local Fund boards. The total estimated value of the projects amounted to Rs. 11,91,201–10–2.

3196—6

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1897.

(*Surgeon Lieutenant-Colonel J. W. Clarkson.*)

General Population.

European and Eurasian Vital Statistics.

By the census of 1891 the European civil population in the Bombay Presidency, exclusive of cantonments in quasi-foreign territory, numbers 18,486 persons. During the year 1897, 257 births and 290 deaths were recorded against 294 and 303 in 1896, respectively—a birth-rate of 13·90 per 1,000 against 15·95 in 1896 and a death-rate of 15·69 against 16·40. By sexes 119 males and 138 females were born against 161 and 133 respectively in 1896, and as regards deaths, 170 males and 120 females died against 188 and 115 respectively in 1896.

The Eurasian population numbers 8,519 persons by the census of 1891, and during the year 1897 the births amounted to 134 against 156 in 1896 and the deaths to 240 against 195—the rates respectively of 15·73 per 1,000 against 18·31 in 1896 and 28·17 against 22·89. Of those born, 72 were males and 62 females against 99 and 57 respectively in 1896, and as regards deaths 123 males and 117 females died against 111 and 84 respectively in 1896.

A table is appended showing the European and Eurasian population in each collectorate and the births and deaths for the year 1897 compared with the births and deaths in 1896, and another table following shows the deaths by causes and the ratios in 1897 compared with 1896 :—

Districts.	No.	Collectorates.	EUROPEANS.					EURASIANS.				
			Population according to Census of 1891.	Number of Births.		Number of Deaths.		Population according to Census of 1891.	Number of Births.		Number of Deaths.	
				1897.	1896.	1897.	1896.		1897.	1896.	1897.	1896.
Western Registration District.	1	Khándesh	239	11	7	20	4	293	5	7	9	3
	2	Násik	833	14	9	9	12	212	1	3	2	2
	3	Thána	391	2	1	1	2	274	—	2	1	3
	4	City of Bombay ...	10,251	161	191	198	207	4,330	81	99	183	152
	5	Kolába	39	—	—	1	1	2	—	—	—	—
Central Registration District.	6	Ahmednagar ...	332	4	2	3	1	36	1	1	—	1
	7	Poona	1,993	24	32	30	43	948	12	12	20	20
	8	Sholápur	270	7	17	3	4	164	5	5	11	4
	9	Sátára	207	9	2	8	2	60	—	1	—	2
	10	Ratnágiri	46	—	2	—	—	18	—	—	—	—
Southern Registration District.	11	Belgaum	389	1	2	1	—	354	1	—	—	—
	12	Dhárwár	305	14	11	4	5	476	12	10	5	3
	13	Bijápur	42	—	1	2	—	11	—	—	—	—
	14	Kánara	69	—	1	1	—	126	—	—	—	—
Gujarát Registration District.	15	Surat	90	—	1	—	1	75	—	—	2	—
	16	Broach	31	—	—	—	1	9	—	—	—	—
	17	Kaira	41	1	1	—	1	19	—	—	—	—
	18	Panch Maháls ...	19	—	—	—	—	17	—	—	—	—
	19	Ahmedabad ...	388	1	3	6	7	142	1	1	1	2
Sind Registration District.	20	Karáchi	2,077	2	3	1	4	685	6	10	1	1
	21	Hyderabad	129	—	1	—	1	41	—	—	—	—
	22	Thar and Párkar ...	5	—	—	—	—	9	—	—	—	—
	23	Shikárpur	231	6	7	2	7	208	7	5	3	2
	24	Upper Sind Frontier	69	—	—	—	—	10	2	—	2	—
			18,486	257	294	290	303	8,519	134	156	240	195

Districts.	No.	Collectorates.	EUROPEANS. Population according to Census of 1891.	Number of Births. 1897.	Number of Births. 1896.	Number of Deaths. 1897.	Number of Deaths. 1896.	EURASIANS. Population according to Census of 1891.	Number of Births. 1897.	Number of Births. 1896.	Number of Deaths. 1897.	Number of Deaths. 1896.
Cantonments in quasi-foreign territory.	1	Aden	Not obtainable.	—	2	—	1	Not obtainable.	—	—	—	—
	2	Baroda		—	—	—	—		—	—	—	—
	3	Bhúj		1	—	—	—		—	—	1	—
	4	Deesa		3	—	2	2		2	1	2	1
	5	Mhow		1	—	2	—		—	3	2	1
	6	Nasirabad		1	—	1	—		—	—	—	—
	7	Neemuch		1	—	—	—		—	—	—	—
	8	Rájkot		2	—	—	—		—	—	—	—
	9	Assirghar		—	—	—	—		—	—	—	—
			—	9	2	5	3	—	2	4	5	2

The causes from which deaths among Europeans and Eurasians were recorded are given in the following table :—

Causes of deaths.		EUROPEANS. 1897. Number of deaths.	1897. Ratio per 1,000 of population.	1896. Number of deaths.	1896. Ratio per 1,000 of population.	EURASIANS. 1897. Number of deaths.	1897. Ratio per 1,000 of population.	1896. Number of deaths.	1896. Ratio per 1,000 of population.
Bombay Presidency.	Cholera	10	0·54	13	0·70	3	0·35	5	0·59
	Small-pox... ...	1	0·05	10	0·54	—	—	4	0·47
	Fevers	90	4·87	55	2·98	110	12·91	39	4·58
		21	**1·14**	**6**	**·32**	**44**	**5·16**	**4**	**·47**
	Dysentery and Diarrhœa.	40	2·16	43	2·33	34	3·99	28	3·28
	Injuries	8	0·43	11	0·60	3	0·35	4	0·47
	Other causes ...	141	7·63	171	9·25	90	10·57	115	13·50
	All Causes ...	290	15·69	303	16·40	240	28·17	195	22·89
		21	**1·14**	**6**	**·32**	**44**	**5·16**	**4**	**·47**
Cantonments in quasi-foreign territory.	Fevers	1	*	1	*	1	*	1	*
	Other Causes ...	4	*	2	*	4	*	1	*
	Total ...	5	*	3	*	5	*	2	*

* As the population for the cantonments in quasi-foreign territory is not obtainable, the ratio of deaths cannot be worked out. The deaths from plague are included under fevers. Figures in block type denote deaths from plague.

Of the 10 deaths registered from cholera among Europeans, 4 occurred in the collectorate of Khándesh, 3 in the City of Bombay, 2 in Sátára and 1 in Ahmednagar. Of the 3 deaths from cholera recorded among Eurasians, 2 took place in the collectorate of Sholápur and 1 in Khándesh.

From small-pox only 1 death occurred among Europeans in the collectorate of Khándesh.

In the City of Bombay during the year under report there were 20 deaths recorded from Plague among Europeans against 6 in 1896.

In the collectorate of Thána the one death recorded among Europeans during the year was due to plague.

Among the Eurasians there were 44 deaths recorded from plague, of which 39 took place in the City of Bombay, 2 in the collectorate of Sholápur, 1 in Násik, 1 in Poona and 1 in Surat.

Native Population—Vital Statistics.

Births.—In the Presidency of Bombay, including Sind, during the year 1897 there were 629,693 births registered against 691,847 in 1896. The recorded births for the year under report were less by 62,154 than the number registered in the previous year

and also less by 23,163 than the mean of the preceding ten years ending 1896. By sexes there were 327,573 males and 302,120 females against 359,097 and 332,750 respectively in 1896.

The following table shows the number of births registered in each year from 1887 to 1897, their ratios per 1,000 of population and the proportion of males to females :—

Years.	Population.	Number of Births registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 male Births the females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1887	16,454,414	327,500	300,693	628,193	19·90	18·27	38·18	52·13	47·87	91·81
1888	16,454,414	330,316	304,377	634,693	20·07	18·50	38·57	52·04	47·96	92·15
1889	16,454,414	312,974	287,515	600,489	19·02	17·47	36·49	52·12	47·88	91·87
1890	16,454,414	333,698	307,417	641,115	20·28	18·68	38·97	52·05	47·95	92·14
1891	18,820,346	354,630	328,047	682,677	18·84	17·43	36·27	51·95	48·05	92·50
1892	18,820,346	337,150	313,517	650,667	17·91	16·66	34·57	51·82	48·18	92·99
1893 ...	18,820,346	345,424	318,881	664,305	18·35	16·94	35·30	52·00	48·00	92·32
1894	18,820,346	342,911	317,357	660,268	18·22	16·86	35·08	51·94	48·06	92·55
1895	18,820,346	350,115	324,189	674,304	18·60	17·23	35·83	51·92	48·08	92·59
1896	18,820,346	359,097	332,750	691,847	19·08	17·68	36·76	51·90	48·10	92·66
Mean for 10 yrs.	17,873,732	339,382	313,474	652,856	18·99	17·54	36·53	51·98	48·02	92·37
1897	18,820,346	327,573	302,120	629,693	17·41	16·05	33·46	52·02	47·98	92·23

The recorded birth-rate for the year was 33·46 per 1,000 of population against 36·76 in 1896 and a mean of 36·53 for the previous ten years.

Of the 24 collectorates and districts the number of recorded births in 1897 was higher than in 1896 in Thána, Thar and Párkar, and Upper Sind Frontier. The remaining collectorates show a decrease as compared with 1896, for which plague and famine sufficiently accounts. In Bombay City the birth-rate usually low is rendered still lower by plague and the exodus occasioned by it.

The Deputy Sanitary Commissioner, Central Registration District, remarks that the large decrease in the number of births (30,059) in the Central Registration District is due to the effect of famine and plague.

The Deputy Sanitary Commissioner, Sind Registration District, remarks that there has been monthly decline in the register of births until April 1897, when the plague was making its ravages. From May upwards, when the plague showed signs of disappearance, the total number of births increased monthly up to October, by which time Sind was free from plague.

The recorded birth-rates among the urban and rural populations of the Presidency were 24·85 and 34·66 against 29·61 and 37·76 in 1896. Except in the collectorates of Ratnágiri, Dhárwár, Bijápur, Kánara, Kaira, Panch Maháls, and throughout Sind, the birth-rates were higher among the rural than in the urban population.

Out of 56 towns in the Presidency, 18 had a birth-rate exceeding 40 per 1,000. Poona, Thána, Bombay, Násik and Alibág have very low birth-rates.

Deaths.—Among the civil population in the rural, town and cantonment circles in the Presidency 749,916 deaths were registered during the year 1897. In 1896, 596,472 deaths or 153,444 less than in 1897 were recorded.

The following statement shows the number of deaths recorded in each year since 1887 :—

1887	... ...	455,261	1891	... ..	513,132	1895	... ...	538,540
1888	... ...	468,039	1892	... ...	611,742	1896	... ...	596,472
1889	... ...	518,562	1893	... ...	511,831	1897	... ...	749,916
1890	... ...	463,616	1894	... ...	607,179			

Of the total deaths registered, 396,154 occurred among males and 353,762 among females, against 312,458 and 284,014, respectively, in 1896.

The computed death-rate per 1,000 of population in 1897 was 39·84 against 31·69 in 1896 and a decennial mean of 29·53. The millesimal rates of males dying to males living was 40·68, and of females dying to females living was 38·95. In 1896 these ratios were respectively 32·09 and 31·27. For every 100 females who died 111·98 deaths among males were recorded, but these proportions vary considerably in the following collectorates :—

In Khándesh the ratio of male to female deaths was			113·37 per cent.
„ Násik	do.	do.	118·86 „
„ Thána	do.	do.	113·53 „
„ Bombay	do.	do.	133·74 „
„ Kolába	do.	do.	113·68 „
„ Ahmednagar	do.	do.	114·36 „
„ Sholápur	do.	do.	113·55 „
„ Kánara	do.	do.	112·83 „
„ Kaira	do.	do.	121·98 „
„ Panch Maháls	do.	do.	119·95 „
„ Karáchi	do.	do.	122·30 „
„ Hyderabad	do.	do.	124·35 „
„ Thar and Párkar	do.	do.	116·75 „

The recorded death-rates per 1,000 of population were higher than in 1896 in all the collectorates and districts, except in the collectorates of Broach, Kaira, Panch Maháls, Ahmedabad, and Hyderabad and the district of Thar and Párkar. The recorded death-rate per 1,000 of population was higher than the annual mean of the preceding ten years in all districts except the collectorates of Broach, Kaira, Panch Maháls, Ahmedabad, and Hyderabad.

Deaths by sexes.—In the City of Bombay, Shikárpur, Upper Sind Frontier and Thar and Párkar the recorded death-rates of females were higher than those among males. In Broach and Karáchi the death-rates of males and females were about equal. In the remaining collectorates the death-rates of males exceeded those of females. In 1896 the females death-rates exceeded those among males in the City of Bombay, Thána, Karáchi, and Upper Sind Frontier.

Deaths by ages.—Taking the ages at the time of death, there was an increase in the ratio per 1,000 of population at every age period as compared with last year, and as usual the infantile mortality was very high. In times of famine and distress it is the people at the extremes of life who succumb, and this is exemplified in the present case, as the largest increase in the death-ratios per 1,000 of population was in the case of "infants under 1 year" and people of "60 years of age and upwards." Taking the percentage on total deaths under one year, the percentage is 18·19 against 20·46 in 1896 and 22·30 in 1895. Under 5 years of age the percentage is 36·33 as compared with 40·49 last year, and in old people of 60 and upwards the percentage is 14·57 as against 13·57 last year and 14·81 the year before. The period of greatest immunity was, as in the past two years, in the age period of above ten and under fifteen. The deaths this year have been more evenly distributed amongst the age periods, the percentage on total deaths amongst children under 5 years of age being over 4 per cent. less, in the age period "60 and upwards" 1 per cent. more, and the remaining increase being divided amongst the other age periods.

Deaths by caste or class.—According to the Census of 1891, the Mahomedan population numbered 3,501,910 persons, amongst whom, in 1897, 105,548 deaths were recorded against 85,746 in 1896, the death-rate being 30·14 per 1,000 of population against 24·48 in 1896. The Hindu population amounted to 14,897,629 persons, amongst whom 635,114 deaths or 42·64 per 1,000 of population were registered. In 1896 the total deaths amongst this race were 502,590, equal to a death-rate of 33·74 per 1,000 of population. Amongst the Christian population, numbering 122,089 persons, 4,608 deaths were reported during the year against 3,016 in 1896, the death-rate being 37·74 against 24·70 in 1896. The Pársi population amounted to 73,945 persons,

amongst whom 2,408 deaths, or 32·56 per 1,000 of population were recorded. Under the heading "Other Castes" are included all those not belonging to either of the above sects, who, by the census of 1891, numbered 224,773 persons, amongst whom there were 2,238 deaths or 9·95 per 1,000 of population recorded during the year 1897. Among Mahomedans the maximum death-rate during the year (72·95 per 1,000) took place in the City of Bombay, and the minimum (14·13) in Hyderabad. In 1896 the maximum death-rate was 53·08 in the City of Bombay, and the minimum 16·04 in Hyderabad. Among Hindus the maximum death-rate (57·44 per 1,000) was in the City of Bombay and the minimum (21·99) in the collectorate of Panch Maháls. In 1896 these rates were Násik (44·77), and Thár and Párkar (23·53) respectively.

Deaths by causes.—The subjoined table shows the deaths in 1897, arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1896, and the mean of the preceding ten years. The causes of death will be briefly noticed in the next section :—

Causes of deaths.	Mean for 10 years, 1887–1896.		1896.		1897.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	25,531	1·43	35,404	1·88	57,109	3·03
Small-pox	3,710	0·21	6,443	0·34	3,835	0·20
Fevers	370,325	20·72	412,229	21·90	452,596	24·05
			2,086	**0·11**	**46,944**	**2·49**
Dysentery and diarrhœa ...	38,449	2·15	36,046	1·92	85,966	4·57
Injuries	5,894	0·32	6,238	0·33	6,907	0·37
Other causes	84,528	4·73	100,112	5·32	143,503	7·62
All causes	528,437	29·56	596,472	31·69	749,916	39·84
			2,086	**0·11**	**46,944**	**2·49**

N.B.—Figures in thick type denote deaths from plague which have been included under "Fevers."

The recorded death-rates among the urban and rural population of the Presidency were, respectively, 56·73 and 37·49 per 1,000 of population, against 37·21 and 30·92 in 1896. Among the rural population the death-rates were higher than in the urban population in the collectorates of Belgaum, Dhárwár, and Kánara. The difference is most marked in Kánara, where the rural death-rate exceeded the urban by 12·16.

Chief Diseases.

Cholera.—In the year 1897 there were 57,109 deaths recorded as due to cholera compared with 35,404 deaths from the same cause in 1896. The province of Sind was free from the disease, the Gujarát district suffered but slightly, and the collectorate of Kánara was lightly affected. The Deccan districts, in which famine prevailed, suffered most.

In December 1896, 911 deaths were reported from nine districts. These districts were Bombay City, Kolába, Ahmednagar, Sholápur, Sátára, Belgaum, Dhárwár, Bijápur and Kánara. In January cholera had ceased in Bombay City, Kolába and Ahmednagar, but continued in the other districts, Ratnágiri being affected in addition. There were 1,225 deaths reported in seven collectorates. During February and March the same collectorates continued to be affected, the mortality diminishing in February but rising again in March. In April the same districts reported deaths, and in addition Bombay City was affected. In May, in addition to the above, the Kolába, Poona, Surat and Broach districts returned cases, and the mortality in the Sátára District was especially heavy and the spread was in a great measure due to workers on famine relief camps dispersing when any outbreak occurred, and thus spreading the disease and also falling victims themselves, as by not continuing on the works they did not get the famine relief. In the Belgaum and Bijápur districts also, both famine affected areas, the mortality was especially heavy. As regards Surat, Broach and the other Gujarát collectorates the mortality was slight, and also after May the Kánara collectorate was so slightly affected that they need not be further considered.

In June all the Deccan and Konkan districts were affected and continued to be so to November; the famine affected districts of Násik, Poona, Sátára and Belgaum suffered severely in June. In July the highest number of deaths from this disease were returned. The districts of Ahmednagar, Poona, Sholápur and Sátára were chiefly attacked, the collectorate of Poona showing a high mortality. In this district all famine camps but two were closed on account of the rains, and no doubt the people living in their own homes and not on well-ordered famine camps, receiving regular though small payments, fell off in condition and were rendered more liable to suffer from this and other bowel diseases. Matters began to mend in August, improved month by month as the year closed, so much so that, at the close of the year, for the month of December only 121 deaths from eight circles were reported.

By seasons: 37,054 deaths occurred in the rainy season of 122 days; 14,060 in the hot and dry season of 61 days; 4,083 in the cold season of 121 days; and 1,912 in the hot and damp season of 61 days.

Out of 220 rural circles 138 were affected by cholera during the year. Out of 56 town circles 41 were affected: and out of 20,545 villages in the districts affected by cholera, 3,456 or 16·82 per cent. were attacked during the year. The highest percentage (41·95) took place in the Poona collectorate, where out of 1,187 villages 498 were affected. In Sátára, Belgaum, Sholápur, Bijápur and Ahmednagar collectorates the percentages were 38·87, 37·69, 33·38, 31·71 and 16·13 respectively, and in the remaining collectorates the percentages were below 15 per cent.

Small-pox.—During 1897 there were 3,835 deaths from small-pox (2,005 males and 1,830 females) against 6,443 in 1896 and a decennial mean of 3,710. There is an increase in the number of deaths in the Central and Sind registration districts, but on the total number the deaths are less this year by 2,608, and the ratio per 1,000 of population is 0·20 this year as against 0·34 last year, and 0·21 the decennial mean. The decrease is most marked in the Western and Gujarát circles. As regard collectorates, there is an increase in Ahmednagar, Poona and Sholápur in the Central Registration District, Dhárwár and Bijápur in the Southern, Broach in the Gujarát, and Karáchi, Thar and Párkar and Upper Sind Frontier in the Sind Registration District. The highest death ratios occurred in Broach 1·13 and Thar and Párkar 1·01, and the lowest 0·01 in the Ratnágiri and Kaira districts. According to age 29·46 per cent. of the small-pox deaths occurred amongst infants under one year of age, whilst 46·39 per cent. took place among children over 1 and under 12, the remaining 24·15 being among persons over 12 years of age.

Fever.—During 1897, 241,140 males and 211,456 females, or a total of 452,596 persons were reported to have died from fever against 412,229 in 1896, showing an increase of 40,367 deaths for the year, the mean for the previous ten years being 370,325. In the Western Registration District fever caused a high mortality—28·66 per 1,000 during the year against 24·08 in 1896 and the decennial mean 20·70. The increase is chiefly due to the prevalence of plague in Bombay, and it is quite clear that many plague deaths escaped registration as plague deaths and were put down to other causes. In the Central Registration District the death ratio was 25·28 against 21·40 in the previous year and 20·27 the ten years' mean. If the number of deaths registered as due to plague is deducted from the deaths due to fever, the fever deaths would be less than last year. In the Gujarát Registration district the ratio for the year was 22·73 against 29·42 in the previous year and 28·55 the decennial mean—less than the previous year's ratio and the ten years' mean, in spite of a heavy outburst of plague in the Surat district. In the Sind and Southern Registration Districts the respective ratios for the year were 21·16 and 19·60 against 19·34 and 14·87 in the previous year, and 18·13 and 16·57, the ten years' mean. With the exception of the Town and Island of Bombay, the collectorate of Poona heads the list with a high ratio of 32·22 against 22·16 in 1896 and 20·73 in the previous ten years; and the lowest ratio 13·54 was attained in the Hyderabad collectorate, the Presidency rate being 24·05 against 21·90 in the previous year and 20·72 the decennial mean.

Although famine was present, yet owing to the scanty rainfall in the latter part of the monsoon of 1896, the deaths from fever would in all districts except the Southern and Western Registration Districts have been about equal to the numbers reported last year. In the Gujarát Registration District the death ratio per 1000 would have been lower than for many years past. I am unable to account for the increase in the Southern Registration

District: the increase in the Western Registration District is, I think, due to deaths from plague being entered as due to fever, as the fever deaths (excluding deaths returned from plague) in Bombay City are abnormally high.

In spite of the plague the fever mortality, which was noted as low in the last three months of the year 1896, continued below the figures of the corresponding months of the previous year up to the end of May 1897, but exceeded the ten-year mean. In June the lowest fever mortality for the year is as usual reported, though it is higher than that for the corresponding month of the previous year and the corresponding decennial period. After June a rise takes place, and the maximum mortality is reported in August and continues high till the end of the year.

In accordance with the desire of the Army Sanitary Commission a slight meteorological sketch for the year is appended. There was no rain for the first three months of the year. Very light showers fell in April and May except in the Belgaum district, but in June the monsoon began, and fell throughout the country in a very favourable way. The maximum temperature diminished with the rainfall, and also did the range, but increased again when the rain ceased. The price of food-grains seriously increased, and the maximum price was reached in August, but favourable rains in September caused a fall.

Dysentery and Diarrhœa.—During 1897, dysentery and diarrhœa caused the deaths of 46,309 males and 39,657 females, or a total of 85,966 persons against 36,046 in 1896 and a decennial mean of 38,449—an increase of 49,920 over last year and of 47,517 over the decennial mean. The Central Registration District heads the list with a ratio of 8·53 per 1,000 against 2·70 in 1896 and 2·30, the decennial mean. The Western Registration District comes next with a ratio of 5·49, the Southern Registration District 4·84, the Sind Registration District 0·37, and the Gujarát Registration District 0·35. In the Presidency the rate was 4·57 against 1·92 in the previous year and a decennial mean of 2·15. All the collectorates excepting Panch Maháls and Ahmedabad show higher rates than in the previous year. High ratios were recorded in Sholápur 12·22, Poona 9·70 Násik 9·32, Sátára 8·22, Ahmednagar 7·76, Bijápur 6·47, Belgaum 6·38, Kolába 6·04, Ratnágiri 5·85, and Khándesh 5·29; and the lowest 0·07 in Panch Maháls and 0·06 in the Upper Sind Frontier. There is no doubt that the large rise in mortality from dysentery and diarrhœa is due to famine. In areas where the famine most prevailed, the mortality is seen to be the highest, and those areas upon the fringe of the famine, such as Thána, Kolába, Ratnágiri, Dhárwár and Kánara, the death-rate is also high. The increase in the Gujarát Registration District, which was unaffected by famine, is slight. In Sind, in which the number of deaths was more than double that of the preceding year and the death-rate was more than twice that of the decennial mean, there was, the Deputy Sanitary Commissioner Sind Registration District reports, "comparative dearness of "provisions in the province."

Injuries.—During 1897, 3,993 males and 2,914 females or a total of 6,907 persons met with violent deaths. The mortality from these causes is more by 669 than that reported in 1896, when 6,238 deaths were recorded. Of these deaths 3,016 occurred from drowning, 1,221 resulted from snake-bites, 663 from wounds, 198 from hanging, 94 from poisoning, 97 from attacks by wild beasts, and 1,618 from causes not specified.

Other Causes.—The recorded deaths from causes other than those specified number 143,503, of which 72,265 occurred among males and 71,238 among females. The total for 1896 was 100,112, so there is an increase of 43,391. Under this heading all deaths are included which cannot be classed under cholera, small-pox, fever, dysentery and diarrhœa, and injuries. The number under this heading may be expected to increase as more accuracy in entering the causes of deaths is attained, but in the year under report the prevalence of famine and plague has no doubt led to the large increase under this heading.

Sanitary Works.

All available information under these sections has been thrown in a tabular form, and will be found in Appendices IV. and V.*

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* Not reprinted.

There were 167 Municipalities in the mofussil with a population of 2,232,737 souls and an income of Rs. 58,92,572. Out of this income, Rs. 33,71,008 or 57·21 were allotted for sanitary works, and out of this allotment Rs. 28,60,607 or 84·84 per cent. were spent. Out of the total expenditure, Rs. 14,77,597 or 51·65 per cent. were spent on conservancy, Rs. 9,07,896 or 31·74 per cent. were spent on improvement of water-supply, Rs. 1,71,085 or 5·98 per cent. on improvement of town sites, Rs. 51,658 or 1·81 per cent. were spent on construction and repairs of markets and slaughter-houses, Rs. 14,034 or 0·49 per cent. were spent on sanitary arrangements during fairs and festivals, and Rs. 2,38,337 or 8·33 per cent. were spent on other sanitary objects, including construction and repairs of tanks, &c.

The Bombay Village Sanitation Act of 1889 under the conditions laid down in Government Circular No. 45, dated 5th January 1895, and under a modified form sanctioned in Government Resolution No. 1090, dated 6th March 1896, has been introduced in 62 other villages during the year 1897, making a total of 282 since the introduction of the Act. In 38 of the 62 villages of the Poona Collectorate the requisite notifications were issued under Part II of the Village Sanitation Act in 1897, and eventually confirmed, but the Act has not yet been formally introduced.

Personal Proceedings and General Remarks.

The plague and famine, which had visited the Presidency in the latter half of the year 1896, continued on in 1897, and great suffering and a high death-rate has resulted. The plague continued throughout the year, but owing to the timely rainfall, especially in September, the cultivators were encouraged to return to till their fields, and the famine works closed, except in three places.

The touring during the year was chiefly for famine purposes, but visits of inspection for selection of sites of plague hospitals and camps were also made. The districts of Sátára, Poona, Ahmednagar, Násik, Khándesh and Thána were visited.

Throughout the presidency, owing to the plague, much more attention is being devoted to the sanitation of towns and villages, and so far this is beneficial; but in the larger towns, works of a more permanent sanitary character will have to be undertaken if sanitary improvement is to be kept up. One such useful measure for Bombay is now under consideration—a scheme to open out Bombay and provide it with wide streets and sanitary dwellings under the guidance and control of a Building Trust. It is to be hoped that on the Board of Trustees a medical officer will be appointed to enforce his views in the proper sanitary building of houses and chawls, and that advice on such important points shall not be gathered here and there from various Medical and Sanitary authorities by the different members of the Trust. Another town, which will certainly need attention in the way of abolishing insanitary houses and providing proper water-supply and sewerage, is Poona. At present the town, though clean, pours the contents of its cesspools into one of the streams running through it, and this is banked up by the water of the Mutha River, and a foul, almost stagnant, stream results. For large towns with an adequate water-supply nothing but a well-devised sewerage scheme is suitable. The incessant watchfulness necessary when cesspools, &c., are cleared out by hand will never be maintained in a Native town, by Native agency.

Plague.

A brief sketch of the course of the plague during the year is given.

Particulars are not entered into, as these may be obtained from the exhaustive reports (noted below) which have been written by the various officers employed in plague operations and published by Government or Local authority.

1. Account of Plague Administration in the Bombay Presidency.
2. Supplement to above.
3. Report on the outbreak of Bubonic Plague by the Municipal Commissioner.
4. Report on the Bubonic Plague in Bombay by the Chairman, Plague Committee.
5. Report on the Plague in Karáchi under the Plague Committee.
6. History of the Plague in Sind by the Acting Commissioner in Sind.
7. Report by the Collector, Karáchi.

8. Report on the outbreak of Bubonic Plague in the City of Karáchi by the Medical Officer of Health.
9. Investigation on Plague by Mr. E. H. Hankin.
10. Joint report on the Epidemic of Plague in Lower Damaun.

Great power and assistance was given to all authorities by the passing of the Epidemic Diseases Act, III of 1897, on 4th February 1897, which conferred very large powers.

The general course pursued was, as regards preventive measures, to hinder those coming from an infected area from entering a healthy town or village, by detention at an observation camp till freedom from infection was assured and the person and personal effects disinfected.

When the disease was apprehended, or had appeared in a town, usually a small committee with full powers supervised the whole proceedings. Otherwise in a district the Collector managed the business. In large towns a committee is preferable, provided it is not too large. The town was divided into wards and a Superintendent in charge of each, with suitable assistance, which comprised a searching staff, a medical staff and a cleansing staff.

The searchers, under carefully framed rules, visited the houses, and if any sick were found, the medical staff were called in to diagnose the case, which, if considered plague, was removed to hospital and the other inmates to a segregation camp to be disinfected and remain there for 8 or 10 days. The cleansing staff then cleaned and disinfected the infected building. In some instances in large towns, instead of searching daily, the Superintendent watched the daily number of deaths, and kept a list of the sick, any suspected case being examined. If the number of deaths mounted up, the ward was searched, and if it could be done, the people turned out into camp.

As a rule all the houses were cleaned and opened up either by the staff or the owners, and sanitation strictly adhered to. All deaths had to be reported, and if the cause of death was not clear, a medical inspection was made. In large towns every now and again, without warning to the people, the whole searching staff was concentrated on a given ward, a cordon having been put round to prevent ingress or egress, and the whole place rapidly and thoroughly searched with a minimum of inconvenience to the inhabitants, and this was very useful in those cases in which wards had become seriously infected. Another good measure, though it could not always be done, was to turn the whole ward out into a camp outside whilst the houses were cleaned and opened up to light and air.

In addition, at various points on the railway, inspection stations were organised and travellers examined, and according to the rules in force either those who were sick were only detained, or all travellers were detained for a fixed period, disinfection of the person and effects being also carried out.

Of the twenty-four circles including Bombay the plague had not appeared at the end of 1896 in the districts of Násik, Sátára, Ratnágiri, Belgaum, Dhárwár, Bijápur, Kánara, Panch Maháls, Thar and Párkar and Jacobabad. Local or indigenous cases had been reported in Bombay City, Ahmedabad, Karáchi, Bándra and Bhiwndi towns and in one village of the Kolába Collectorate. In Ahmedabad Town the local cases (2 in number) were reported at the very beginning of the outbreak there, but the rest were imported. Imported cases only had been reported as occurring in the collectorates of Khándesh, Ahmednagar, Poona, Sholápur, Surat, Broach, Kaira, Hyderabad and Shikárpur.

In January, cases occurred in the districts of Násik, Sátára, Ratnágiri and Belgaum. In February a case occurred in the Thar and Párkar District, and in March 2 cases in the Jacobabad Circle.

The first case reported in the Dhárwar District was in October and in the Bijápur District in November. The districts of Kánara and the Panch Maháls alone returned no cases of plague during the year, and the districts of Khándesh, Ratnágiri, Dhárwár, Bijápur, Broach, Kaira, Thar and Párkar and Jacobabad were but lightly visited.

At the end of 1896 there had been a total of 2,908 attacks and 2,086 deaths, and the following table gives the progress of the disease by months in each of the 24 circles.

No.	District.	Total for 1896.		January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total for 1897.		Grand Total from September 1896 to 31st December 1897.	
		Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.
1	Khándesh	6	5	6	1	8	4	7	1	2	2	3	3	5	5	—	—	2	1	1	1	—	—	1	—	68	58	103	76	109	81
2	Násik	—	—	24	16	10	10	6	3	4	2	1	—	—	—	5	4	132	92	314	271	227	175	268	212	398	290	1,389	1,075	1,389	1,075
3	Thána	129	95	423	324	1,208	948	1,709	1,350	1,373	999	429	262	107	17	88	4	149	47	249	77	363	46	161	26	93	56	6,352	4,156	6,481	4,251
4	City of Bombay	2,542	1,803	2,374	1,335	3,172	3,072	2,495	2,266	1,418	1,277	448	328	186	99	62	44	124	70	222	169	290	178	371	255	805	644	11,967	10,237	14,509	12,040
5	Kolába..	14	13	19	19	114	84	212	158	629	608	228	188	36	35	22	16	38	28	81	62	51	38	48	40	39	33	1,517	1,309	1,531	1,322
6	Ahmednagar..	6	4	5	3	7	4	8	4	—	1	—	—	—	—	—	—	12	9	44	32	117	77	138	89	220	167	551	386	557	390
7	Poona	53	39	205	159	300	238	1,284	910	730	510	98	78	21	15	198	118	954	619	1,147	825	2,272	1,640	2,951	2,139	1,811	1,520	11,971	8,871	12,024	8,910
8	Sholápur	1	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	15	9	260	199	1,211	983	1,357	1,162	2,846	2,353	2,847	2,354
9	Sátára	—	—	3	3	3	3	3	2	1	1	—	—	—	—	198	107	1,316	1,024	2,118	1,543	4,214	3,127	3,692	2,858	1,694	1,363	13,242	10,031	13,242	10,031
10	Ratnágiri	—	—	5	5	6	6	—	—	—	—	—	—	—	—	—	—	9	9	—	—	2	1	5	5	—	—	27	26	27	26
11	Belgaum	—	—	1	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14	6	222	162	331	275	569	444	569	444
12	Dhárwár	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13	10	27	23	6	5	46	38	46	38
13	Bijápur	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	2	3	3	3	3
14	Kánara..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	Surat	23	21	34	27	174	118	903	703	793	615	120	98	19	19	66	36	46	22	178	126	459	274	907	579	617	475	4,516	3,371	4,339	3,091
16	Broach	5	5	4	4	5	2	6	2	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16	9	21	14
17	Kaira	11	10	3	—	2	—	1	1	—	—	—	—	1	1	—	—	—	—	1	—	—	—	—	—	1	1	8	3	20	13
18	Panch Mahális	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	Ahmedabad	54	29	24	19	20	10	22	15	9	6	7	6	3	3	—	—	2	2	1	—	1	2	1	1	1	1	135	95	147	94
20	Karáchi	63	59	844	768	1,202	1,052	1,232	905	787	574	244	179	26	20	13	9	—	—	1	1	9	1	66	48	18	15	4,442	3,572	4,505	3,631
21	Hyderabad	1	1	30	26	24	19	134	98	389	295	65	60	1	1	—	—	—	—	—	—	—	—	—	—	—	—	643	499	644	500
22	Thar and Párkar	—	—	—	—	1	1	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3		3	2
23	Shikárpur	1	1	2	1	12	8	287	219	499	351	160	124	27	13	—	—	—	—	—	—	—	—	—	—	—	—	987	[illegible]	988	717
24	Jacobabad	—		—	—	—	—	2	2	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	3	3

The figures shown are from returns received in this office and do not tally with returns elsewhere published. In the general returns the deaths are included under the heading "Fever."

Khándesh.—The plague was kept out of this district, only imported cases being reported (most of which were detected at the railway inspections) up to December, when Jalgaon town was infected. There were 109 attacks and 81 deaths in 11 villages.

Násik.—The outbreak began in January, but was very slight, and the numbers of cases and deaths declined till in May and June there were practically none. In July, however, the district was again re-infected and during the latter half of the year there was a serious outbreak; altogether 60 villages were affected and 1,389 attacks and 1,075 deaths reported.

At one village the opposition to plague measures led to the villagers assaulting the medical men and others coming to the village to prosecute plague measures.

Thána.—Up to the end of December 1896 thirteen towns or villages had reported cases which were all imported cases except in the towns of Bándra and Bhiwndi, which had become infected. The imported cases numbered 22, the local cases 107, total 129, and there had been 95 deaths. After the beginning of the year 1897 the attacks and deaths increased very rapidly, attaining the maximum in the month of March and then declining till a minimum was reached in the month of August, after which there was an increase, but kept within narrow limits till the close of the year. Besides the 13 villages in 1896 there were 83 other villages infected in 1897.

An interesting account of the plague in this district by the Collector, Mr. Logan, I.C.S., appears on page 191 of the Bombay Presidency Report, in which he quotes from the reports furnished by Surgeon-Major A. V. Anderson, Deputy Sanitary Commissioner, Western Registration District, and Assistant Surgeon R. R. Dadina, the Medical Officer of Kalyán town and the Vice-President of its Municipality. Very rightly is the work of Assistant Surgeon Dadina praised, and it shows how in a crowded and dirty town vigorous measures of inspection, segregation and disinfection can keep the disease down.

Bombay City.—Long and admirable reports have been written on the outbreak in this city and the measures taken to minimise the outbreak, by the Municipal Health Officer, the Chairman, Plague Committee, and the Health Officer of the Port of Bombay. By the close of 1896, 2,542 attacks and 1,803 deaths had occurred. In spite of great zeal and energy in cleansing and searching out cases on the part of the Municipal Executive, the mortality from the disease continued to rise, there being no rigid enforcement of isolation and segregation measures, and attained its highest maximum in the week ending 16th February 1897, on which date the total mortality for the week stood at 1,710, of which the reported plague deaths were returned at 845. At the end of the previous week the total mortality was 1,891 with 745 reported plague deaths. After the 16th February the mortality from all causes began to decline. By the end of February a Plague Committee was constituted which began work by appointing a Secretary on the 2nd March and setting to work by building hospitals, searching, isolating, and segregating. The fall after the 16th continued, and the total mortality for the week ending 29th June was 517, of which the reported plague deaths were 11. In fact, in the month of June the total mortality was 2,163, whilst the attacks and deaths from plague were returned at 186 and 99 respectively. In July there was a further fall, and 62 attacks and 44 deaths from plague were returned, but the total mortality for the month was higher, after which a recrudescence began and a second and severe outbreak took place, the total attacks and deaths for the year 1897 being returned as 11,967 and 10,237.

To prevent cases of plague being carried by sea or being imported, a system of medical inspection of ships, their crews and passengers was organised and successfully worked by Surgeons-Major MacCartie, C.I.E., and Crimmin, V.C., a full report of which is in the account of plague in the Bombay Presidency.

Kolába.—The district was not severely affected; the cases, as a rule, occurring at coast towns or villages easily reached from the sea-board and being introduced from Bombay. The outbreak began in January (imported cases being detected early in October) and reached its maximum severity in April. The total numbers are not large, but to combat it strained to the utmost the zeal and energy of the authorities. The total numbers reported are 1,531 attacks and 1,322 deaths.

Ahmednagar.—With the exception of local cases the disease did not show itself in this district till September, when an outbreak began, increasing in severity to the close of the

year, but the total attacks were 557 and deaths 390. The high death-rate shown by this district is due to the effects of famine.

Poona.—In this collectorate only the chief town had become infected by the end of the previous year and in this town the vigorous measures organised by a Committee under the late Mr. Rand, I.C.S., brought down the death-rate and almost freed the town from the plague in June, but a recrudescence or re-infection took place, and in July a rise in the attacks and deaths took place leading to another serious outbreak. In the whole collectorate 119 towns and villages were affected, and there were 12,024 attacks and 8,910 deaths.

Sholápur.—The plague was kept out of this district till September, after which a sharp outbreak commencing in Sholápur town took place, and continued increasing in severity up to the close of the year. 69 villages were infected during the year and there were 2,846 attacks and 2,353 deaths. This was a famine-affected district, but fortunately the famine had closed when the serious outbreak began. I understand that many of the inhabitants got out of Sholápur town at the first indication of a serious spread of the disease and thus infected other villages.

Sátára.—This collectorate escaped lightly up to the end of June, but there were a good many people who returned to their homes from Bombay and probably also from the Poona District, and the serious outbreak began in Karád town and from there the infection spread, especially up the eastern side of the collectorate. 194 towns and villages were infected and there were 13,242 attacks and 10,031 deaths reported.

Ratnágiri.—This district was very lightly affected. There were 27 attacks and 26 deaths in 10 villages—all near or upon the coast.

Belgaum.—With the exception of two imported cases early in the year, this collectorate escaped till October, when an outbreak commenced affecting 6 towns and villages, in which 569 attacks and 444 deaths occurred.

The districts of Dhárwár and Bijápur were lightly affected, and Kánara not at all.

The report on the outbreak and progress of plague in the Province of Sind by Surgeon-Captain H. C. L. Arnim, D.P.H., Deputy Sanitary Commissioner, Sind Registration District, is appended :—

" As pointed out in the Deputy Sanitary Commissioner's report for the year 1896, plague was first detected in Karáchi City early in the month of December. Up to the termination of the year 1896, 63 cases and 59 deaths from plague have been reported. These cases were all of local origin ; the most careful enquiries having failed to discover the original case or cases importing the disease. At this period the remainder of the Sind Province with the exception of Kandiáro and Shikárpur, into which towns cases had been imported, was free from the disease.

" 2. During the year 1897, plague gradually spread along the main lines of communication ; and it was not until 16th August 1897 that Sind was declared to be entirely free from the disease. During this period, 6,057 cases and 4,770 deaths had been reported in the province.

" 3. Among these figures, those resulting from a second and localized outbreak in Kotri town (the first case of which was reported on October 28th) have been omitted. The details of this outbreak will be referred to later.

" 4. In this report it is intended to refer to the disease as it appeared in 5 districts into which the province is divided. In the case of the Karáchi District, the statistics referring to the Karáchi Town Circle have been prepared separately from those of the remaining portion of the district.

" 5. *Karáchi Town Circle.*—As stated above, the disease was present in the town of Karáchi at the commencement of the year under report, and it was not until 27th July 1897 that the epidemic was finally stamped out there. During this period, 4,180 cases and 3,396 deaths were reported in the circle.

To repeat : plague first appeared in the Karáchi Town Circle on December 10th 1896, the last case being reported on July 27th 1897. During this period, 4,180 cases and 3,396 deaths were reported. Of these cases all, excepting 15 cases imported, were of local origin.

" 6. *Karáchi District excluding Karáchi Town Circle.*—As before stated, at the end of the year 1896, plague was reported from no other part of this district, excepting in Karáchi town.

" During the year 1897 plague was reported from 9 of the rural circles of the Karáchi District. In all, 231 cases and 169 deaths occurred. Of the cases, 188 were imported ones, and 43 were reported as of local origin. In these rural circles no less than 46 towns and villages were affected ; but only from 4 places were local cases reported, the others reporting only imported cases.

" The last case reported from the Karáchi District (excluding Karáchi Town) was on 26th May 1897.

" It is regretted that details are not available, in the office, for the preparation of mofussil tables, showing cases and deaths by castes and age periods.

" 7. *Hyderabad District.*—In this district, a case (an imported one) had been reported from the Kandiáro Circle on December 27th 1896.

" During the year 1897, plague was reported from 9 rural and urban circles in the Hyderabad District. In all, 644 cases and 500 deaths occurred. Of these cases 80 were reported as imported, and 564 were of local origin. No less than 23 towns and villages were affected ; but from only 3 places were local cases reported, the others reporting only imported cases.

" The last case reported from the Hyderabad District was on 2nd June 1897.

" No data are available for the preparation of caste and age tables for this district.

" 8. *Shikárpur District.*—An imported case was reported from Shikárpur Town on December 30th 1896. This is the date of the first appearance of the disease in Shikárpur District.

" During the year 1897, plague was reported from 10 rural and urban circles in this district.

" Altogether 996 cases and 700 deaths occurred, of which cases 115 were imported and 881 of local origin. Forty-two towns and villages were affected ; local cases being reported from 24 places, the others reporting only imported cases.

" The circles have been mentioned in the order in which the disease first appeared in them.

" The last case reported from the Shikárpur District was on June 24th 1897.

" No data are available for the preparation of caste and age tables.

" 9. *Thar and Párkar District.*—In this district the disease was reported from only one circle, Mirpur Khás. Between the dates of 15th February and 27th March 1897 three cases, all imported ones, were reported from the town of Mirpur Khás. Two of the cases were fatal. The disease was reported from no other part of this district.

" 10. *Upper Sind Frontier District.*—Here three cases were reported from one circle (Jacobabad) between the dates of 13th March and 6th April 1897. Two cases were imported, the third being reported as of local origin. All three cases were fatal. The disease was not reported from any other part of this district.

" 11. Regarding the second outbreak of plague reported from Kotri town referred to in paragraph 3 of this report. The first case was reported on 28th October 1897 (the town having been free from plague since). The origin of the outbreak was stated to be unknown. But it is probable that the disease was re-imported into the town from an infected area outside the province.

" Up to the end of the year, 93 cases and 64 deaths were reported from this town. All were of local origin.

" 12. During the whole period of the epidemic the Deputy Sanitary Commissioner was ordered to remain at Karáchi, to advise the local authorities as to the measures to be adopted in dealing with the local outbreak, the incidence of the disease being far heavier in Karáchi than in any other part of the province.

" On 12th December 1896, the Karáchi Municipal Health Officer had shown some suspicious cases to the Deputy Sanitary Commissioner, which cases the latter diagnosed to be plague. The Deputy Sanitary Commissioner took immediate steps to acquaint the Local Medical and Revenue authorities of the presence of the disease in the city, and also wrote to the Municipality regarding the measures which he considered should be adopted under the circumstances. A report was also made to the Sanitary Commissioner with Government, and copies forwarded to the Local Revenue Officers. Later on (4th February 1897) the Deputy Sanitary Commissioner was placed in special medical and sanitary charge of the Sadar Bazár, and powers under the Epidemic Diseases Act granted to him ; to these duties were added (in February 1897) those of the medical and sanitary supervision of the suburban areas (those portions of the Municipal area without the old Native City). Finally (on 20th March 1897) the Deputy Sanitary Commissioner was appointed medical member of the Karáchi Plague Committee.

" 13. A few words may be added as to the earlier steps taken by the Deputy Sanitary Commissioner with a view to check and control the spread of epidemic diseases in the province.

" It is one of the recognised duties of the Sanitary Officer to be prepared with measures to combat, *on its earliest incidence*, any epidemic outbreak which may appear within his district. In reference to this duty, it is in the first instance necessary to consider the legal powers which exist for the carrying out of the measures to be recommended. Without legal authority for enforcing their application, sanitary recommendations are useless. When it is seen that existing legal powers are not sufficient for the rapid application of emergent measures, it becomes clearly the duty of the Sanitary Officer to point out the deficiency to the proper authorities.

" 14. In the correspondence ending with his letter No. 932, dated 26th June 1896, the Deputy Sanitary Commissioner had pointed out the deficiencies in the Bombay District Municipal Act with regard to the existing powers for dealing with emergent epidemic outbreaks ; and had suggested amendments and additions. In his letter No. 959, dated 3rd July 1896, the Deputy Sanitary Commissioner had pointed out the dangerous manner in which infectious disease was spread from town to town and from village to village in the province, and had suggested remedies for the future prevention of the spread of disease by these channels.

" In his letter No. 1243, dated 18th August 1894, the Deputy Sanitary Commissioner had also suggested simple measures for preventing the spread of infectious diseases by river craft. The Sanitary Department in Sind had not been behind hand in pointing out the most urgent deficiencies in the existing laws and regulations for dealing with emergent epidemic outbreaks, and in suggesting measures for their reconstruction and amplification.

" Had powers existed, on the first appearance of plague in the province, to deal with the earlier cases in accordance with recognised methods, there is not the slightest doubt that incalculable saving in life and property would have resulted."

The disease is spread chiefly through human intercourse. In noting the beginning of the various local outbreaks, there is nearly always some history of importation from an infected area, and the maps attached to reports show how the disease spread along the lines of railway and extended to ports served by coasting steamers and vessels. It appears to me clear that human intercourse is the great factor in the spread of the disease—not of course by the human being alone, but also by means of his clothing and the personal effects he carries from one place to another, and hence the necessity of disinfecting not only the person of a traveller from an infected area but also his personal effects. Rats are also the carriers of the disease. Instinct warns them to migrate, and those infected travel as far as they can, infecting others, and those arriving at their destination spread the disease in houses. There is an interesting note on this subject by Surgeon-Major Anderson, Deputy Sanitary Commissioner, Western Registration District, on observations made by him in the Thána District and also by Surgeon-Captain T. E. Dyson, Deputy Sanitary Commissioner, Gujarát Registration District, in his report on the outbreak in Bulsár. A certain time elapses before the infection gets a firm hold of the town or village, as indicated by the death-rate after the first probable infection from without. It of course varies and is by no means well-defined, but it would appear to be at least a month ; the period, however, appears much shorter when rats introduce the disease. Once the infection is in a town it seems to cling to houses ; probably it is the floor constantly poisoned by emanations from the sick and rats. The prompt evacuation of an infected quarter, sending people to a camp, and opening up houses, has almost always been followed by good results.

As a detailed account of plague in its medical aspect will be written by the Surgeon-General, only brief general observations are inserted here.

The period of incubation may be from two to ten days. It is generally five days. Cases have occurred where the period of incubation appeared to have extended over ten days, but in some cases this was probably due to opening bundles of personal clothing of a previous case which had not been disinfected.

Males are attacked more frequently than females, but the death-rate amongst females is high. Pregnant women attacked, abort and die. The majority of those attacked are between 20 and 40 years age, but no period of life is exempt.

The plague with buboes is the most frequent. The pneumonic form of plague, though more difficult to diagnose, is the more fatal. The great majority of buboes occur in the lower half of the body, but whether in the upper or lower region they are most frequent on the right side.

The mortality is very high—over 60 per cent. of those attacked die, but when at hospitals the cases dying within 24 hours after admission are eliminated the death is below 50 per cent.

Cases have occurred in which the same individual has had a second attack after an interval, but these cases are few.

The preventive inoculation introduced by Mr. Haffkine, C.I.E., must not be unnoticed. Accounts of the procedure have already appeared. I have little doubt but that the inoculation is efficient, but for how long the effect remains there is not as yet sufficient evidence to show, nor as regards the after-effects; but no evidence has been forthcoming to show that any serious permanent after-effects have been induced.

Report of the Sanitary Board for 1897.

Preliminary.—The year under report does not show any great progress in sanitary works. Owing to the special measures taken by Government, due to the plague, the ordinary sanitation of towns and villages has been very much better looked after, and the general state of cleanliness is probably better than it has ever been, and the Board hopes that this state of things may continue after the plague has passed away; but, unless municipalities are dealt liberally with as regards plague expenditure, many projects will be delayed indefinitely for want of funds.

Shikárpur.—The municipality have shelved the proposal to carry out a small water-supply scheme, preferring to continue relying on wells sunk in a sub-soil saturated with centuries of sewage, and they are allowing more private wells to be sunk in the town each year; in most cases these are sunk in the ground floor of the houses themselves, or in a small enclosure where cattle are kept. Many of the streets have been paved with bricks, and a considerable length of side gutters has been made, to carry off the waste water from the numerous wells to the outside of the crowded town. As they insist on these wells, these gutters are decidedly beneficial as far as they go, and every well ought to have a connection with them. The waste water and sullage is at present collected in two large hollows to the west of the town, whence it ought to be pumped, and properly utilised; if all the waste water was taken there, the sullage would be sufficiently diluted for effective use.

The removal of sewage, both liquid and solid, is most primitive and insufficient; and probably not one-tenth part is actually taken outside the town. Many of the side streets are simply latrines, and the supervision is very inefficient. Rubbish is at present filled into a large hollow.

Sukkur.—This municipality has now got a fairly good water-supply, obtained by driving tunnels under the river Indus, through the rock. The first one struck a large spring, which, it was hoped, would give a sufficient supply. A peculiarity of this spring was that the temperature of the water, as it gushed out of the rock, was 12° to 13° *higher* than that of the river water above the tunnel. The discharge of the spring was found to fluctuate to some extent with the height of the river; and in the cold weather, when the river was at its lowest, the spring supply was insufficient. A second tunnel has therefore been driven, and the supply is now believed to be sufficient. The water is pumped by a pair of Worthington engines, to iron tanks on a tower on a small hill, and distributed thence in iron pipes to cisterns and stand-posts.

The special Engineer, lent to the municipality by Government, also worked out an excellent and economical drainage scheme for the municipality, a very necessary measure upon the completion of a water-supply; but the municipality are hesitating, and propose another scheme of surface drainage in connection with their present drains, which ought not to be allowed; as the existing drains are little better than elongated cesspools, which are infecting the subsoil.

Hyderabad.—After years of delay the municipality have at last, under the advice of the Sanitary Board, provided themselves with a pair of Worthington engines for the lift into the storage reservoir in the fort; and have laid down a branch main to supply the cantonment reservoir, instead of having a separate small engine for it. It is extremely probable, from the examination of the dismantled engines, that they would not have stood the strain of the next hot season's work, when the consumption would have increased as usual; but although the terrible results of a breakdown were repeatedly pointed out to them, they only consented at last, after much pressure, to get the new

engines. Much still remains to be done to put their water-supply on an efficient footing. The engines at the river lift, which pump the water into an aqueduct through which it flows into the reservoir whence the fort lift engines raise it into the town, are worn out. One is practically a dummy, as it is unable to lift the water at all when the river is at its lowest ; and the other is now driven much beyond its capacity, and the strain may cause it to break down any day. As the whole supply depends on this lift, the replacement of these engines by an efficient plant is a matter of extreme urgency ; but nothing can be done without money, and the municipality have not yet even raised the loan to pay for the fort engines and cantonment branch, simply because in the present state of the market they find that they have to pay a higher rate of interest than they expected to have to do when the question was considered two years ago. Other very necessary additions to the water-works are :—

(1) Improvements to the settling tanks.
(2) Provision of filter beds.
(3) Covering in the reservoir whence the fort engines pump the water.
(4) Covering in the fort reservoir.
(5) Providing a high-level steel tank in the fort.

The last is very necessary, as the present masonry reservoir in the fort cannot be relied on, owing to bad design and construction, although it has stood hitherto. The municipality have had a drainage scheme drawn out under the instructions of the Sanitary Board, but now talk of shelving it, and extending their inefficient system of surface drains, which are already a nuisance.

Karáchi.—The municipality have completed their drainage scheme for the city, on the Shone system ; great difficulties were experienced, owing to the proximity of the subsoil water ; but the result is a complete success, and house connections are rapidly being made. It only remains to extend the system to the cantonment, which is under contemplation. The sewage is utilised on a farm, which is a remarkable instance of the success, both financially and from a sanitary point of view, of broad irrigation carried out intelligently and under proper supervision.

Karáchi has undoubtedly suffered from an overabundant water-supply, and its unrestricted use has resulted in enormous waste, causing a rise in the subsoil water, and a serious increase of febrile diseases. The municipality has now realised the evil, and are about to charge a rate for the water, which, it is hoped, will check the waste. The large European element in this municipality, and the fact that it has for years had a most efficient and experienced Secretary and Engineer, account for its progressiveness in sanitary matters.

Viramgám.—Nothing has been done here. The boring for an artesian supply, which is much wanted owing to the brackish surface water, has progressed no further. The work is under the Public Works Department.

Ahmedabad.—This municipality is fortunate in having the Honorable Mr. Runchorlál Chotálál as President, whose wonderful energy and foresight, and influence with the people, have enabled him, with the assistance of the Collector, in forcing through both a water-supply and a drainage scheme, against the strong opposition that is invariably experienced when such schemes are first mooted for up-country towns. As usual, however, the people have soon appreciated the benefits, and the use of water has increased to such an extent that a third engine is now being ordered. The drainage scheme has been drawn out by Mr. Baldwin Latham, and a section of one-fifth of the city has been completely sewered, with good results. It is now proposed to carry out the rest of the scheme. The one defect is in the sewage farm, which has been badly managed from the beginning, and is too small. The municipality have, however, recently acquired 300 acres at a further distance of about 3 miles from the city, and propose to lay it out, and manage it, on the scientific principles that have been so successful at Karáchi ; and they are preparing to extend the sewage main to it. It is also hoped that cultivators in the vicinity will buy the sewage.

Dohad.—The Public Works Department carried out the testing of a large well for the water-supply of the town, both for quantity and quality. The results were satisfactory, and the municipality are apparently eager for the supply, but nothing further has been done.

Godhra.—The sanitary state of this town is very defective, and the municipal supervision is very insufficient. A report has been made to the Collector by the Sanitary Engineer.

Dákor.—The sanitary arrangements in this town are not good. A report has been made to the Collector by the Sanitary Engineer. A trial of a well, as a source of water-supply, was a failure, both as regards quantity and quality ; but as there is a large tank near the town, there can be little doubt that proper investigation would procure a good and sufficient supply from the subsoil.

Surat.—The water-works are now, at last, nearly finished; but the extension to Ránder, and some of the distribution arrangements, require completion. The municipality were fortunate in having, in the Public Works Department Executive Engineer, one of the few officers who have made a special study of water-works, and one who has not been discouraged by the procrastination of the municipality, from urging the matter continually. The engines are Worthington's, which raise the water from wells sunk in the river Tápti, into steel tanks on towers, whence it flows into the city. It is remarkable that although the tide affects the level of the river to a point considerably higher up than the head-works, yet it does not affect the quality of the subsoil water obtained from the covered wells sunk in the river bed.

Dhulia.—The water-works have been completed by the Public Works Department, and a drainage scheme is now under consideration.

Jalgaon.—The water-supply project was drawn out by the Executive Engineer a year ago, but was returned for alteration. Nothing further is known about it.

Málegaon.—The Sanitary Board advised on a proposed survey for a water-supply scheme, which has been under discussion for many years. Nothing further is known of it.

Nasik.—The water-works project is still in much the same state as it has been for the last 20 years. A storage tank was begun as a famine work, but very little was done. Strong and continued pressure will be required to make this municipality attend to the urgent sanitary needs of the town, although they are willing to spend a large sum on a bridge for the benefit of the temples on the other bank.

A drainage scheme is an urgent necessity. One masonry drain has been made, which cuts off a certain number of the cesspools from the holy pools where the pilgrims bathe and drink ; but it discharges into an old drain, about half way down the river front, which is practically a cesspool of the worst kind. From the end of this old drain a pipe takes the sewage across the stream, and discharges it into the sandy bed a few feet beyond, whence it flows along a channel in the sand, close to the stream.

Yeola.—The water-works here are being carried out by the Public Works Department, but have come to standstill owing to non-receipt of engines and pipes.

Ahmednagar.—The water-supply for one-third of the town, comprising about the same number of people and at about the same cost as the Yeola scheme, was entrusted to the Sanitary Engineer, and is now finished ; and the trial of the engines is most satisfactory. These are 6 H. P. oil engines, by Clayton and Shuttleworth, and this is the first installation of the kind in India for water-works. The scheme for the rest of the town, on similar lines, has been drawn out ; but it depended on the construction of the Kapurwádi Tank, which was undertaken as a famine work; and as only one-fourth of that work was finished, its completion is a matter that will cause delay to the water-supply scheme.

Poona.—No important sanitary progress of a lasting nature has been made ; but owing to plague, and the special measures taken by Government to suppress it, the town is cleaner than it has been for years. The water-supply and sewerage are matters of extreme urgency, which ought to be faced at once ; and they have been pressed for years. Without a proper water-supply, an efficient sewerage scheme cannot be carried out. That sewerage is a necessity can be seen by visiting the spot where the foul smelling sullage is discharged from carts into a small stream which joins the stretch of water above the Jamsetji Bund ; and this piece of the river is becoming very foul. Even if land for a sewage farm is not available, there are other satisfactory methods of dealing with sewage ; and the town sewage can be, and should be, purified before being discharged into the stream ; and measures to do this should be taken without delay.

Sholápur.—The municipality here are practically depending for their water-supply on one Worthington engine, as their old engine is now incapable of lifting anything like the required supply. The urgent necessity of getting a second Worthington has been

impressed on them for two years, but still they procrastinate. Any accident to their one engine would be disastrous for such a large town.

A survey for a drainage scheme was begun by the Public Works Department, but had to be stopped, as the Overseer was required for the famine. The system of open drains has been carried out here to a large extent, and at heavy cost; and the resulting nuisance, especially from flies and mosquitoes, has at last forced even the municipality to see the necessity of abandoning this system in favour of pipe sewers.

Bársi.—As stated last year, this municipality have seized on *one* unfavourable analysis of a *single* well, to throw up the water-works proposals, and so save themselves from any extra taxation.

Belgaum.—A water-supply project was got up under the supervision of the Board; but is delayed, pending the decision of the Military authorities as to whether they will combine with the town in a joint scheme.

Hubli.—The improvements to the water-supply and drainage, on which the Board have repeatedly advised, have made absolutely no progress. As the town is rapidly growing, something should be done soon.

Gadag.—The Board investigated the question of a water-supply to this rapidly growing town, and advised a preliminary survey; but the Collector appeared to think it inadvisable to have a water-supply without a drainage scheme. This of course is a very correct view; but if always acted on, it would stop sanitary progress in this country altogether. Without a proper water-supply a large town cannot progress; and if funds will not permit (as is invariably the case) of water-supply and drainage being undertaken together, the proper course is to bring in the water first, and deliver it at points where the waste water can be disposed of; and only to extend it generally to the houses when a drainage scheme is carried out.

Akalkot.—This is the chief town of a small Native State, and a water-supply project was got up under the direction of the Board, which, it is hoped, will soon be carried out.

Poona Cantonment.—The Board have advised on certain rules to limit the waste of water in the Sudder Bazár, which waste was a source of increasing sickness. The drainage of the Sudder Bazár is a very urgent matter, and the Board have repeatedly advised its being taken up efficiently. The existing drains are practically elongated cesspools, owing to faulty design and bad gradients; and the stench in the main streets during the hot weather is sickening, even to the natives themselves.

Tirkhundi.—A water-supply project was prepared by the Public Works Department, and returned by the Board, to be recast in accordance with previous instructions.

Awand.—The drainage of the Body Guard Lines has now been re-arranged in accordance with the Board's suggestions.

Sassoon Hospital, Poona.—The drainage of this place is nearly completed, in accordance with the Board's suggestions; but the final testing has not yet been carried out. The Board intend proposing a thorough alteration of the privies and bath rooms of the hospital itself, which are at present very insanitary.

Miscellaneous.—The designs for dispensaries at Ranpur and Hálol, and latrines for various places, were passed by the Board.

Khed.—This town was specially reported on by the Board at the request of Government; and sanitary improvements, suited to the limited funds of the municipality, were suggested.

Government House, Mahábaleshwar.—The Sanitary Engineer advised on the details of the proposed water-supply, and suggested the adoption of a small oil engine plant, as being best suited to the circumstances.

Finally, we would again most urgently draw attention to the remarks in para. 54 of our Report of last year. Owing to plague and famine, it will now be more difficult than ever to get municipalities to carry out sanitary works; and unless some encouragement is given to the very few influential men who take the trouble to interest themselves in such matters, our next year's Report will almost certainly show that progress has fallen off alarmingly.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER 1897.

The following table gives a summary of the shipping and health of the Port of Bombay, and of the work in connection therewith, for the year ending 31st December 1897 :—

Vessels including Native Craft.	Number of Vessels Inspected.	Number of Persons Inspected, including Crew on Vessels.	Number of Vessels Disinfected.	Number of Persons Vaccinated.	Number of Persons rejected or segregated.	Diseases and Number of Cases of Each.					
						Plague.	Cholera.	Small-pox.	Measles.	Scarlatina.	Enteric Fever.
Entered	32,187	602,401	13	111	39,230	79	—	3	3	6	1
Left	40,565	710,716	—	—	3,322	71	—	—	—	—	—
In Harbour during the year ...	56	—	56	50	—	19	30	8	1	3	—
Total	72,808	1,313,117	69	161	42,552	169	30	11	4	9	1
1896	570	112,278	59	777	—	2	38	12	9	3	1

It will be seen from the above table that the numbers of vessels and persons inspected are greater than in 1896. The numbers include every person who left Bombay by sea after 6th February 1897, as well as those who arrived from the ports of Western India between Karáchi and Bhatkal inclusive after 1st April. These wholesale inspections were due to the anxiety of Government to prevent the spread of plague by sea, and were amply justified by the results obtained. The actual numbers of arrivals and departures, including crew and passengers, examined during the period were 1,313,117 souls, and the number of plague cases detected, of which a record has been kept, was 169.

The following table furnishes further particulars regarding vessels which entered the port during the year :—

Year.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which entered Bombay Harbour from Indian Ports.	Number of Passengers.
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1897	551	27,605	204	191	1,583	289,154	36,831	2,217
1896	684	43,527	235	1,886	1,344	378,553	45,685	Unknown

There is no complete record kept of the crew of incoming vessels, and in the case of native craft none of either crew or passengers ; hence the total number of persons who arrived by the vessels shown in the above table cannot be given. Of the 319,167 passengers shown, 15,028 were troops, 2,519 pilgrims from the Hedjaz, and the remaining 301,620 chiefly passengers from ports near Bombay.

The following table shows the number of ships which had infectious disease on board on or before entering the harbour :—

Class of Vessels.	Number of Ships.	Total Number of Crew and Passengers.	Diseases and Number of Cases of Each.						Persons Number of Vaccinated.
			Plague.	Small-pox.	Measles.	Scarlatina.	Enteric Fever.	Number of Plague cases amongst suspects removed to Observation Camp on arrival of the vessel in Port.	
Entered	2	3,046	—	—	2	1	1	—	—
Pilgrim ships	—	—	—	—	—	—	—	—	—
Other vessels	11	3,987	14	3	1	5	—	—	111
Vessels with suspicious cases which turned out to be Plague after arrival.	60	—	—	—	—	—	—	65	—
Total	73	7,033	14	3	3	6	1	65	111
1896	14	9,104	2	3	5	3	1	—	601

Vessels which became infected while in port are not shown in the above table, but are noticed in the table on page 201.

The cases of Measles, Scarlatina and Enteric fever referred to in the foregoing table as having occurred on board the troop-ships were landed and isolated in the Military Cantonment at Colába. The Small-pox cases were removed to the hospital for infectious diseases on shore, and those persons unprotected among the crew and passengers were vaccinated. The 60 vessels shown in the table are those among whose suspected passengers and crew 65 plague cases occurred after the people had been sent to hospital for observation and disposal. The 11 other vessels with 14 cases of plague were those on board of which fully developed cases of plague were found at the time of arrival. They, as well as the 60 vessels shown in the table, came from infected ports in close proximity to Bombay.

Showing the number of vessels, crew and passengers examined on arrival at Bombay.

Months.	Number of Vessels Inspected.			Number of Persons Inspected.							Number of Persons Segregated.		
				Passengers.		Crew.		Total.			Segregated.		Number of crew and passengers.
	Number of steam ships and square-rigged vessels inspected.	Number of native sailing craft inspected.	Total.	Steamships and square-rigged vessels.	Country craft.	Steamships and square-rigged vessels.	Country craft.	Number of passengers.	Number of crew.	Number of crew and passengers.	Passengers.	Crew.	
January	1	—	1	1,361	—	172	—	1,361	172	1,533	—	—	—
February	2	—	2	3,022	—	444	—	3,022	444	3,466	—	—	—
March	1	—	1	250	—	70	—	250	70	320	1	—	—
April	228	3,266	3,494	70,104	11,150	6,522	18,496	81,254	25,018	106,272	447	—	447
May	194	4,806	5,000	73,661	12,258	6,907	30,986	85,919	37,893	123,812	3,047	—	3,047
June	104	1,474	1,578	16,403	2,881	3,955	9,966	19,284	13,921	33,205	1,341	—	1,341
July	89	943	1,032	9,152	973	3,228	6,517	10,125	9,745	19,870	489	—	489
August	100	1,639	1,739	15,344	2,139	4,287	9,956	17,483	14,243	31,726	919	2	921
September	139	3,772	3,911	37,773	4,584	5,506	22,606	42,357	28,112	70,469	3,565	2	3,567
October	158	4,749	4,907	31,630	992	5,309	28,849	32,622	34,158	66,780	10,550	24	10,574
November	156	4,943	5,099	33,464	649	5,429	31,382	34,113	36,811	70,924	9,692	4	9,696
December	160	5,263	5,423	33,282	1,013	5,439	34,290	34,295	39,729	74,024	9,148	—	9,148
Total ..	1,332	30,855	32,187	325,446	36,639	47,268	193,048	362,085	240,316	602,401	39,199	32	39,230

The examinations from April until December include all arrivals from ports on Western India between Karáchi and Bhatkal inclusive, as all such ports were more or less plague-infected.

III.—Outward Vessels.

The following table shows the number of outward vessels and their passengers and crew inspected month by month from 1st January to 31st December 1897.

Months.	Number of Vessels inspected.			Number of Persons inspected.							Registered Number of persons rejected.				Total number of crew and passengers rejected.
				Passengers.		Crew.		Total.			Passengers.		Crew.		
	Number of steamships and square-rigged vessels inspected.	Number of native sailing crafts inspected.	Total.	Steam-ships and square-rigged vessels.	Country crafts.	Steam-ships and square-rigged vessels.	Country crafts.	Number of passengers.	Number of crew.	Number of crew and passengers.	Rejected.	Sent to hospital for observation.	Rejected.	Sent to hospital for observation.	
January ..	26	23	49	5,331	69	3,064	511	5,400	3,575	8,975	—	—	—	—	—
February ..	202	2,313	2,515	44,451	5,387	8,299	14,806	49,838	23,105	72,943	153	—	22	—	175
March ..	299	3,819	4,118	38,698	19,382	13,008	20,855	58,080	33,863	91,943	181	—	32	—	213
April ..	288	4,816	5,104	27,805	10,062	11,990	30,151	37,867	42,141	80,008	189	39	70	7	259
May.. ..	249	5,206	5,455	25,833	10,768	11,946	32,851	36,601	44,797	81,398	155	155	29	29	184
June ..	160	1,797	1,957	16,227	3,196	8,796	12,437	19,423	21,233	40,658	89	70	9	9	98
July.. ..	156	947	1,103	10,677	1,042	8,835	6,660	11,719	15,495	27,214	49	46	12	12	61
August ..	147	1,195	1,342	15,258	2,755	8,628	7,803	18,013	16,431	34,444	87	74	15	11	102
September .	204	3,276	3,480	2,400	3,975	11,165	19,963	6,375	31,128	37,503	283	282	42	40	325
October ..	249	4,480	4,729	33,964	3,250	13,349	26,272	37,214	39,621	76,835	664	664	53	53	717
November .	241	4,824	5,065	30,502	2,640	13,096	30,268	33,142	43,364	76,506	625	625	64	64	689
December..	244	5,404	5,648	30,672	4,310	13,089	34,218	34,982	47,307	82,289	428	428	71	71	499
Total ..	2,465	38,100	40,565	281,818	66,836	125,265	236,795	348,654	362,060	710,716	2,903	2,383	419	296	3,322

Up to the 6th February, only vessels bound for European or other quarantine ports were inspected ; but after that date everything that floated was examined before it left the port, no matter for what place the vessel or craft was bound. The sanitary condition of all outward bound vessels was carefully attended to during the year. The crews' quarters were, as a rule, painted or lime-washed before departure. The inside of crews' boxes were treated in the same manner, and crews' clothes were exposed to the sun. Bilges in native craft were thoroughly cleaned and dried, and the holds of all vessels in ballast were swept clean and in most cases lime-washed or disinfected with carbolic acid lotion. The overcrowding of crews' quarters noticed in previous years was not marked during the year 1897. During the year the overflow pipes from the water tanks on board of some vessels were found to discharge directly into the bilges. This state of affairs was found on cargo, passenger and troopships. Such an arrangement as that referred to must be insanitary, more especially if the bilges are foul, as cockroaches, gases, &c., from the holds and bilges can find their way into the drinking-water tanks.

Infectious Disease on Vessels in the Harbour.—The following table includes all steamers, square-rigged vessels and native craft which became infected while lying in port, and is exclusive of those given in the first table on page 199, which became infected while at sea or whose passengers developed plague after arrival :—

Months.	STEAMERS.												BUGGALOWS, TONIES, PROWS, STEAM LAUNCHES, &C.												TOTAL NUMBER OF CASES OF INFECTIOUS DISEASE IN THE BOMBAY HARBOUR.											
	Number of Ships.	Cholera		Small-pox.		Scarla-tina.		Measles		Plague.			Number of Native Craft.	Cholera		Small-pox.		Scarla-tina.		Measles		Plague.			Total number of infected Vessels.	Cholera		Small-pox.		Scarla-tina.		Measles		Plague		
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
January ..	1	—	—	—	—	—	—	1	—	—	—		—	—	—	—	—	—	—	—	—	—	—		1	—	—	—	—	—	—	1	—	—	—	
February .	1	—	—	—	—	1	—	—	—	—	—		1	1	1	—	—	—	—	—	—	—	—		2	1	1	—	—	1	—	—	—	—	—	
March ..	3	—	—	—	—	—	—	—	—	3	3		—	—	—	—	—	—	—	—	—	—	—		3	—	—	—	—	—	—	—	—	3	3	
April ..	2	—	—	3	—	—	—	—	—	—	—		5	—	—	1	—	—	—	—	—	4	4		7	—	—	4	—	—	—	—	—	4	4	
May ..	1	—	—	—	—	—	—	—	—	2	2		1	1	1	—	—	—	—	—	—	—	—		2	1	1	—	—	—	—	—	—	2	2	
June ..	2	1	1	1	—	—	—	—	—	—	—		1	1	1	—	—	—	—	—	—	—	—		3	2	2	1	—	—	—	—	—	—	—	
July ..	—	—	—	—	—	—	—	—	—	—	—		3	3	3	—	—	—	—	—	—	—	—		3	3	3	—	—	—	—	—	—	—	—	
August ..	5	5	2	—	—	—	—	—	—	—	—		2	2	2	—	—	—	—	—	—	—	—		7	7	4	—	—	—	—	—	—	—	—	
September	—	—	—	—	—	—	—	—	—	—	—		2	3	3	—	—	—	—	—	—	—	—		2	3	3	—	—	—	—	—	—	—	—	
October ..	3	2	2	—	—	1	—	—	—	—	—		7	8	4	—	—	—	—	—	—	1	1		10	10	6	—	—	1	—	—	—	1	1	
November	4	—	—	2	—	—	—	1	—	1	1		4	3	2	—	—	—	—	—	—	1	1		8	3	2	2	—	1	—	—	—	2	2	
December .	3	—	—	1	—	—	—	—	—	2	2		5	—	—	—	—	—	—	—	—	5	5		8	—	—	1	—	—	—	—	—	7	7	
												Total ..												Total ..	5-	30	22	8	—	3	—	1	—	19	19	

All the above vessels, including those in the table on page 199, were thoroughly disinfected in accordance with the rules laid down in the Venice Convention.

Disinfection of Ships and General Health of the Shipping.—Sixty-nine infected vessels of various kinds were disinfected during the year, under the personal supervision of the Port Health Officer or his staff assisted by the Water Police. The Director of the Royal Indian Marine saw that the disinfection of transports in which infectious diseases occurred was carried out in accordance with the recommendations of the Port Health Officer.

The health of the harbour population, estimated at 22,142, was fair. Exclusive of plague the total number of admissions into hospitals was 626. The St. George's admitted 438 Europeans, of whom 14 died; the Jamsetji 50 natives, of whom 3 died; and the Goculdas 138 natives, of whom 14 died.

Red Sea Pilgrim Traffic.—Owing to the plague in Bombay only 2 pilgrim ships left for Jeddah in January with a total of 1,106 pilgrims. After that date all Mecca pilgrims were prohibited leaving Indian ports. Over 600 pilgrims were in Bombay at the time waiting for a passage to Jeddah. Government kept them for 10 days in an observation camp and returned them to their homes in Hindustán and beyond the frontier at a cost of over Rs. 13,000. There were no cases of plague and no deaths on board the above two pilgrim ships between the port of Bombay and the Turkish Quarantine Station at Camaran.

During the year the following pilgrim ships arrived from Jeddah :—

S.S. "Pekin"—10th June with 1,021 souls (pilgrims), no deaths.
„ "Naseri"—10th June with 496 souls (pilgrims), 4 deaths.
„ "Mohomedi"—26th July with 519 souls (pilgrims), 13 deaths.
„ "Naderi"—13th August with 483 souls (pilgrims), 3 deaths.

The baggage of all the pilgrims who arrived by the S.S. "Mohomedi" and S.S. "Naderi" was disinfected by the Port Health Officer, as plague was reported to have broken out at Jeddah. The pilgrims were not allowed into the town, but were sent direct from the ship to their homes in batches at the expense of Government.

Sanitary State of the Harbour and Foreshore.—The foreshore was not inspected during the year owing to pressure of work.

Plague.

Many reports on the Bombay plague have been written, but so far no person has proved conclusively from where Bombay received the disease. Some say it was imported from China, while others affirm that it came from the slopes of the Himalayas. It seems to have escaped notice that plague is endemic in the Persian Gulf and the Red Sea Coast—places much nearer home than China—and that quarantine is imposed by Egypt and Aden almost yearly against that port of the Red Sea Coast between Leith and Lohaya and known as Assyr. On reference to the records it will be found that plague was epidemic in Assyr in October 1893, July 1894, August 1895, and October 1896.

As the organization for the medical inspection of all vessels and persons leaving Bombay by sea has been described in a special report by Surgeon-Lieutenant-Colonel MacCartie, M.B., C.I.E., and which will be found as an appendix in the official account of the Plague Administration in the Bombay Presidency for 1897, it is not necessary to go into the details again. The following short account of the harbour operations will therefore be sufficient. Several extracts are taken from Dr. MacCartie's report.

Outward Inspections.—During the earlier part of the epidemic, and up till 6th February 1897, only vessels and persons bound for European and other quarantine ports were inspected. As an exodus of the plague-stricken population of the city had set in, Government decided to have an examination of every vessel and native craft as well as of every crew and passenger which left Bombay by sea for any where. These wholesale inspections commenced on 6th February.

The object aimed at being the prevention of the spread of plague by sea to other Indian ports, to ports outside India, and, above all, to Europe, with its incalculable effects on Indian commerce. No measures were spared to obtain that end, and the most characteristic feature of the inspection became its extreme strictness and searching nature. Plague, moreover, is a disease which requires a very rigid and close inspection for its early recognition. Its main and chiefest signs during the Bombay outbreak were fever and buboes, and all natives with either of these signs became objects of suspicion, their temperatures were taken and they were subjected to the most searching examination in private. During the months of February, March and April the number of persons placed on one side for temperature observation ranged from 20 to 25 per cent., and as many as a dozen rapid registering thermometers were in use at the same time. It need hardly be said that to eliminate the suspicious cases a careful individual examination of each native was necessary, and this included not merely a look at a man's tongue and face and a pulse observation, but a careful exploration of his body for glandular enlargement. Nor was the examination confined to the persons sailing on a vessel. The vessel itself was overhauled and a high sanitary condition insisted on. This included the opening and thorough cleansing of lascars' boxes, which were often found to contain filthy clothes and rubbish quite capable of supporting the plague microbes in comfort and affluence. In fact, it would be impossible, humanly speaking, to devise a more stringent or exhaustive examination for the prevention of the export of plague.

All ship commanders were, in addition, advised as to periodical inspections of their crew during the voyage, and of the advantage of frequent exposure to sun and wind of lascars' clothes and kit, whilst printed instructions were sent to shipping agents for issue to commanders of vessels without medical officers, describing the symptoms and the treatment to be adopted should plague break out on their ships.

The strictness and thoroughness of the examination are described, and insisted on here, not because in the slightest degree do the officials, who carried it out, claim any credit for doing what was merely their duty, but because too much publicity cannot be claimed for the efforts made in Bombay to confine the plague within its own borders. It was noticed that neither lay nor even medical persons seemed to be able to realize how very searching the inspection was, until they had themselves experienced it. If then in India the real nature of the measures adopted by Government for the prevention of plague export cannot be conceived unless seen, it is not too much to expect that the nations of continental Europe, which have signed the Venice Convention, may also, without ocular or, at least, strong evidence, be unable to realize how great were the efforts made here to save them from the infliction which Bombay was enduring. Nor should it be forgotten that when the Indian Delegate at the Venice Convention described the thoroughness of the Bombay inspection, not from hearsay, but from the evidence of his own eyes, his statement was, according to Reuter, received with "satisfaction mingled with incredulity." At that very time, it may be added, a medical officer of the Italian Government, who had been sent to

Bombay to report on the measures adopted there for the prevention of the spread of plague to Italian ports, was expressing his surprise at the completeness of the inspection system here, and was learning from the evidence of his own eyes that the statement made by Dr. Cleghorn was true in every respect. This officer, Dr. Druetti, accompanied the Port Health staff to all vessels bound for Italian ports, generally assisted at the inspections, and became thoroughly acquainted with the Bombay measures of prevention ; and it was due to his favourable views, presumably, that the severe quarantine in force at Brindisi at the time was afterwards removed.

On a reference to the table on page 200 it will be observed that 40,565 vessels, including native craft, with a total of 710,716 outward bound crew and passengers were examined. It is of course impossible to accurately gauge what is the real and exact value to be attached to any system of medical inspection as a preventative to the spread of plague. It cannot discover the disease in its incubating stage, but it can detect signs and symptoms suspicious of the disease ; and if all persons with suspicious signs and symptoms are removed from a vessel, the odds are much in favour of that vessel remaining uninfected.

There is also an indirect effect which follows a strict inspection system, and that is the check on the spread of the disease which arises from plague and suspicious cases not caring to risk the chance of detection once the severe nature of the medical examination has been recognised. This was very marked during the first months of the inspections when it was noticed that, after the system had been acting for a short time, the number of plague and highly suspicious cases presenting themselves for examination considerably lessened.

When it is remembered that only two ocean-going steamers are known to have had plague on board after leaving Bombay from the first appearance of the disease in September 1896 to the present time, it is allowable to claim that the measures adopted by the Bombay Government shall be considered the leading factors in that result, and that a proper system of medical inspection if applied in time is capable of preventing plague from seriously spreading beyond its centre of first appearance to neighbouring parts. It is of course impossible to trace the movements of each passenger who left Bombay by sea for ports across the harbour, and down the coast ; and cases of plague may have got away, by sailing craft and small coasting steamers, even after the strict system of inspection was introduced for passengers by such vessels.

In all cases where plague developed among people who had been rejected from a ship, a telegram was sent to the next port of arrival warning them that a case of plague had been removed from the vessel.

The two ocean-going steamers mentioned above as plague-infected were the S.S. "Pekin," which left Bombay with 1,045 pilgrims for Jeddah on the 28th December 1896, and the hired Government Transport S.S. "Dilwara," which left Bombay for Southampton on 10th March with 172 crew and 1,063 passengers. The pilgrims of the "Pekin" had been in Bombay and living for weeks in a plague-infected locality, and, all things considered, it is wonderful that more cases did not occur.

During the year, 3,322 persons were prevented from sailing in vessels. All persons having any suspicious signs or symptoms of plague were rejected. As there were no camps of observation at the commencement of the year, to which such rejected cases could be sent for observation, they were allowed to return to their homes in the city, as it would not be fair to send them to a plague hospital. In the early part of the year only fully developed plague cases and markedly suspicious ones were sent to hospital. It is, therefore, impossible to give the number of cases which developed among those rejected and who were, therefore, prevented from leaving Bombay by sea, but the number of plague cases, of which we have a record, is 71, which is much below the actual figure.

Inward Inspections.—Large numbers of the city population, who had fled from Bombay in December and January, began to return as the plague declined. They had already scattered the disease far and wide over the Presidency, and they rushed back to the city, which they had abandoned in panic, with as much eagerness as they had originally left it. Public opinion, fearing the effects on the health of Bombay from this inrush of people, many of whom came from plague centres and famine districts, demanded some check on the importation of plague cases ; and, under the directions of the Plague Committee, the inspection of arrivals by sea from places within a defined area was organized and placed in working order.

Karáchi in the north was heavily infected, and the whole coast more or less as far south as Goa was either infected or in communication with infected places. Accordingly, Karáchi on the north and Bhatkal on the south inclusive were fixed as the limits of a

prescribed area from ports and places within which vessels on arrival at Bombay should be medically inspected.

These inward inspections were commenced in April, and a reference to the second table on page 199 will show that 32,187 vessels and 602,401 crew and passengers were examined. Of these incoming passengers, 39,199 were segregated for periods varying from 2 to 10 days. Those persons coming from very slightly infected ports, and who were suffering from fever, were kept under observation until their temperatures became normal, which usually took place in 1 or 2 days ; whereas those persons who came from heavily infected ports and from infected ships were detained for periods varying from 8 to 10 days according to the distance of the port from Bombay. Many of the above-mentioned 39,199 passengers, who were sent to the observation camps, were allowed out on the surveillance system. The heads of castes stood security and guaranteed that they would turn up periodically for medical inspection. Before such people were allowed out on surveillance certificates, they were photographed in groups and desired to present themselves at stated periods for inspection. The system is said to have worked well and few plague cases were found amongst them after the suspicious ones had been weeded out by the Port Health Staff. The actual number of plague cases detected at the inspections on arrival or that developed among those suspicious cases which had been isolated was 79.

The combined results of the inward and outward inspections as well as those in the harbour show that 72,752 vessels of all sorts were inspected, 1,313,117 crew and passengers were carefully examined, and 169 cases of plague discovered.

The Port Medical Staff have been engaged on a form of plague duty which is perhaps the most unpleasant that can be conceived. Cut off from almost all that interested them in their profession they have spent months and months on long and weary rounds of monotonous inspections. The exigencies of an enormous passenger traffic, and of commerce generally, necessitated hours of work which left little time for meals and none for recreation. Work began at 6 A.M. and rarely ended before 7.30 P.M. The public idea as to the simple nature of the inspections has been already alluded to and their real character explained.

Duties, which at no time were pleasant or easy, became too often loathsome and difficult. The exploring of some of the filthiest parts of the human body for enlarged or tender glands cannot under any circumstances be other than disagreeable ; and when this operation has to be repeated through days and weeks and months, it can only be described as nauseating and monotonous drudgery. Those only who have been through it can thoroughly appreciate how great was the sense of duty required to prevent, under such conditions, a searching examination from degenerating to a mere superficial and perfunctory observation.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1897-98.

(*R. T. Greer, Esq., Acting-Chairman.*)

Town and Bustee Improvement.—The total amount spent by the Corporation on town and bustee improvements during the year 1897–98 was Rs. 57,340, against Rs. 52,576 in the preceding year. Exclusive of the outlay on latrines (Rs. 11,237) the total sum expended was Rs. 46,103, of which Rs. 37,917 was absorbed by town improvements, and only Rs. 8,185 on bustee improvements, construction of bustee roads, &c.

Waterworks.—The extensions of filtered water mains during the year aggregate 2·56 miles. The total length of filtered water pipes now amounts to 314·62 miles. The number of premises connected during the year amounts to 591, raising the total number to 27,775. The average daily consumption of filtered water during the year was 20,638,212 gallons, against 20,786,655 in 1896–97. The consumption of filtered water per head per day is estimated at 38·10 gallons in town and 11·26 gallons in suburbs, against 14·42 and 10·94 in the previous year.

The daily unfiltered supply was 5,461,823 gallons, and the daily consumption 12·51 gallons. A scheme for the extension of the unfiltered water-supply in the town area was carried out during the year at a cost of Rs. 5,46,254, the work being completed in March 1898. This has resulted in an extension of the unfiltered water main by over 15½ miles, the total length of pipe now amounting to 96·50 miles, with which are connected 1,906 premises, 135 public conveniences, 86 bathing platforms, 320 sewer flushing chambers, and 2,973 ground hydrants. The bathing platforms have since been disconnected from the unfiltered supply and reconnected to the filtered main. Besides this, a second project for extending the unfiltered water-supply in the suburbs is also being carried out, the length being estimated to be 221,700 feet and the cost Rs. 4,93,514.

Drainage and General Construction.—During the year 3·24 miles of pipe-sewers were entirely reconstructed to a new specification. 1·44 miles of kirb and channel stones were set in public streets. All the brick-sewers were carefully examined after the earthquake of 12th June 1897, and as a result of this examination, 1·12 miles were repaired and cement-pointed. The main outfall sewer between Circular Road and Palmer's Bridge silt-pits appears to have suffered most, and it was necessary to put in 663 lineal feet of strong tie-rods and to wedge all the cracks. There have been constructed during the year 54 new gully-pits, 28 sewer man-holes, 31 sewer lamp-holes and 10 flushing chambers, fitted with Miller's patent automatic syphons. The sewers including 9·42 miles of bustee sewers now measure about 200 miles. Of works of public convenience, 3 bathing platforms have been completed and brought into use ; 4 have been thoroughly repaired ; 1 night-soil pail depôt of large size has been constructed, and 2 thoroughly repaired and improved. One 12-seated latrine on the "model trough" system has been constructed ; as also a 4-seated latrine with white-glazed tiles. Besides these a combined latrine and urinal for gentlemen and a retiring-room for ladies have been constructed in the north and south quadrangles of the New Market. 12 public latrines have been thoroughly repaired. 5 Bombay pattern urinals with white-glazed tiles have been constructed in public streets, and 10 have been repaired. 2 mehters' barracks have been reconstructed. 3 hackney carriage stands have been constructed, paved with stone-setts. 317,250 tons of refuse were conveyed by the Municipal Railway to the square-mile and unloaded, as compared with 307,200 tons in the previous year. In addition to this, 19,478 tons of road metal and building materials were hauled from the store depôt at Bagh Bazar and unloaded at the various sub-depôts in Circular Road.

The quantity of refuse removed from the town is increasing year by year. An increase of 23,000 tons appears in the quantity hauled down to the square-mile and unloaded, and a further increase of 10,000 tons during the year under report.

House Drainage.—The number of premises connected with the public sewer during the year was 260, bringing the total up to 29,848. The drains of 8,601 premises were inspected during the year, and out of this number 2,955, or 34 per cent., were found more or less defective. Notices to rectify, specifying the defects, were issued in all cases ; 9,176 re-inspections also were made. The number of privies connected with the sewers under the new rules was 31, bringing the total up to 1,084.

Roads.—The total length of roads on 31st March 1898, within municipal limits, was 331 miles 4 furlongs and 115 feet, of which 104 are stone metalled, 165 brick metalled, 35 over sewered ditches, and 25 unmetalled.

Price of Food.—Owing to the extensive failure of crops in the country the price of food exceeded the average of the ten preceding years. The price of common rice, which averaged Rs. 4–0–5 per maund during the previous ten years, in 1897–98 rose to Rs. 5–2–3 per maund.

Health of the Town.—The birth-rate was the same as in the preceding year (18·4 per 1,000), but showed an increase on the average of the preceding eight years. The death-rate was higher than in any of the previous eight years, with the single exception of 1895. The figures are shown as follows :—

Year.	No. of Deaths.	Death-rate.
1889	19,564	28·7
1890	20,368	29·8
1891	21,517	31·5
1892	20,180	29·6
1893	20,103	29·5
1894	22,441	32·9
1895	27,031	39·6
1896	24,356	35·7
1897	25,665	36·1

Special attention has been again drawn by the Health Officer in his report to the increased mortality among infants under one year of age, and suggestions have been made for the better regulation of the milk-supply of Calcutta.

The increase in the general mortality, as compared with the figures of the preceding year, was due to an increase under all causes excepting cholera which showed a decrease. Deaths from small-pox were comparatively few, being only 161 against an average of 467 for the eight years from 1889 to 1896. 17 of these cases are traceable to Howrah and other places beyond the limits of Calcutta. On the other hand, death from fevers as well as from diarrhœa and dysentery, though fewer than in the year 1895, considerably exceeded the average of the eight years preceding 1897 ; while deaths from causes other than cholera, small-pox, diarrhœa, dysentery and fevers largely exceeded the corresponding figures of each year from 1889 to 1896. The annual number of deaths from fevers in urban Calcutta in the past four years was the highest recorded in any of the past 29 years with the single exception of 1878. The highest number of deaths in suburban Calcutta recorded in any year since the amalgamation was that of 1897.

Special stress is laid in the Health Officer's report on the defective registration of births and of causes of death. It is suggested by him that private cemeteries for the disposal of the dead should not be permitted in Calcutta, and that the neighbouring municipal and district authorities should be asked to supply this Corporation with regular returns of cremation and burial of persons within their jurisdiction dying in Calcutta.

The precautions taken against the plague were briefly—

(*a*) The division of the city into 17 (subsequently into 10) circles, each under a qualified medical man.

(*b*) The medical inspection of persons arriving in Calcutta from places infected by plague, and the inspection of lodging-houses and grain-depôts in Calcutta.

(*c*) The completion of a plague hospital at Manicktola and the elaboration of a complete scheme, including sites for the construction of plague hospitals within the city to combat an outbreak of plague.

(*d*) The addition of a hand ambulance of the pattern employed at Bombay.

(*e*) The provision of an equifex disinfector and an equifex disinfecting sprayer, both worked by steam, and a force-pump for flushing *gullies* ; also the laying in of a stock of disinfectants.

(*f*) The continuation of the post of Chief Superintendent of Conservancy to supervise the town cleansing and sanitary departments under the Health Officer, and the appointment of a special staff for cleaning and lime-washing filthy localities and unclean houses.

This establishment at first consisted of 2 superintendents, 1 inspector, 13 sub-inspectors, 1,500 coolies and 343 carts. It was subsequently reduced to 498 coolies only ; again increased to 1 superintendent, 3 inspectors, 12 sub-inspectors, 665 coolies, 57 carts and 3 sweeping-machines ; and finally reduced to 1 superintendent, 1 inspector, 6 sub-inspectors, 403 coolies and 54 carts.

Owing to an outbreak of small-pox in Howrah and neighbouring places, and its moderate prevalence in Calcutta, the number of cases of vaccination rose from 11,976 in 1896–97 to 21,620 in the year under review. This number largely exceeds that of any previous year since 1892 except 1895, the figure for which is exceptionally high owing to the abnormal prevalence of small-pox in the town in that year.

Anti-choleraic inoculation according to Haffkine's method was practised during the first three months of 1897.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1897.

(*Dr. J. Nield Cook.*)

The period under report saw some changes in the post of Health Officer of Calcutta. Dr. W. J. Simpson, who was Health Officer from the 1st January to the 6th September 1897, retired before a permanent successor to him had been appointed, and Dr. R. Sen was appointed to act until I was elected and joined on the 7th January 1898. As I only held office for a short period during the year under review, the greater part of the report has been written by Dr. Sen and only revised by me.

Meteorological Condition and Food and Water Supply.—The variations in the atmospheric pressure during the greater part of the year 1897 were small, the lowest reading 29·540 being recorded in June, and the highest 30·021 in December. The mean daily variations of temperature were, as in the previous year, greatest from January to June and from October to December, and least in August. The mean maximum solar radiation was highest in April and May. The atmospheric humidity was greatest in August and least in April. Rain fell during all the months except November and December, the number of rainy days during the year amounting to 128. A total of 58·33 inches of rain fell during the year, and the maximum monthly total rainfall and the maximum fall in 24 hours both occurred in July.

Price of Food.—The price of food was much higher in 1897 than the average of the preceding ten years. Common rice was sold on the average at Rs. 5–2–3 against Rs. 4–0–5 per maund. Oil (mustard) and salt sold at prices higher than the mean of the previous ten years, but fuel was cheaper. Meat and other articles were sold at the Municipal Market at rates higher than the average of the previous ten years.

Water-supply.—The quantity of filtered water for drinking and other domestic purposes supplied to the town averaged over 30 gallons daily per head of the population. The supply maintained its general purity throughout the year.

Vital statistics.

Births.—The number of births (children born alive) recorded during the year 1897 was higher than that recorded in five out of the previous eight years. There were 12,584 births, giving an annual birth-rate of 18·4 per 1,000 of the population. The figures for the past nine years are as follows :—

Year.	No. of Births.	Birth-rate per 1,000.
1889	12,317	18·0
1890	11,918	17·4
1891	12,477	18·3
1892	12,688	18·6
1893	13,492	19·7
1894	11,438	16·8
1895	10,945	16·0
1896	12,608	18·4
1897	12,584	18·4

As usual, the highest birth-rates were those of the Christians and "other classes," and the birth-rate was greater among the Hindus than among the Mahomedans. The greater birth-rate among Hindus than among Mahomedans appears to be due, at least partly, to the Hindu population being in the main more residential in character than the Mahomedan population of Calcutta. According to locality, the birth-rate was greatest in added area of Burtollah, Ballygunge, Hastings and Baniapooker wards, and was least in Waterloo

Street and Park Street wards. The male births fell below the female births in only three districts, namely, the added area of Moocheepara, Baniapooker and Khidderpur, and male and female births were practically equal in one district, namely, Puddopooker. In all the remaining wards the male births exceeded the female births, the excess being greatest in the added area of Shampooker and in Bamum Busti, Burrabazar and Colootola wards.

General Mortality.—The general mortality of the town during 1897 was greater than that of the previous year, and also exceeded the average of the preceding five years. There were 24,665 deaths from all causes, being a mortality of 36·1 per 1,000 of the population against 24,356, or a ratio of 35·7, in 1896, and against 22,822, or a ratio of 33·5, the mean of the five years from 1892 to 1896. The following figures give the numbers of deaths and death-rates in Calcutta during the past nine years, namely,—

Year.	No. of Deaths.	Death-rate per 1,000.
1889	19,564	28·7
1890	20,368	29·8
1891	21,517	31·5
1892	20,180	29·6
1893	20,103	29·5
1894	22,441	32·9
1895	27,031	39·6
1896	24,356	35·7
1897	24,665	36·1

A decline in the public health of Calcutta was noticed in the reports of 1895 and 1896. A similar decline in the public health is noticeable in the year 1897. In comparison to the previous quinquennium, this decline was greater in the suburban area than in the old town area, and in the area bordering on the circular canal than in the rest of the suburbs. The death-rate in urban Calcutta rose to 32·2 in 1897 against 30·4 the average of the previous five years, while the death-rate in the suburbs rose to 44·7 against 39·9 the mean of the previous five years ; and the ratio in the canal area was 43·6 against 39·4, and in the rest of the suburbs 35·7 against 34·0. When a comparison is made with the year 1896, however, it is noticed that, while there was an improvement in the general health of all the urban wards except Shampooker, Coomartooly, Jorabagan, Burrabazar and Moocheepara, there was a deterioration in the suburban parts of three out of the four extended wards as well as in three out of the seven suburban wards.

The incidence of mortality, as usual, varied greatly according to age. Thus, out of the 24,665 deaths that took place during the year, no less than 6,817, or more than a fourth part, occurred within the first five years of life ; and while only 2,924 deaths, or 11·8 per cent., took place between five and twenty years of age, 6,710 deaths, or 27·2 per cent., occurred between the ages of twenty and forty, 4,153 deaths, or 16·8 per cent., between forty and sixty, and 4,061, or 16·4 per cent., from sixty years upwards. If the numbers of deaths at different ages be considered in relation to the proportion of the population at those respective ages, it is seen that while the death-rate per 1,000 of the population between the ages of five and sixty is not excessive for an oriental city, that between the ages of one and five years is at least five or six times what it should be in a healthy town, and that under one year of age amounts to 458·5 per 1,000, which is proportionately at least as excessive.

In comparison to the previous year there was an increase in the death-rate under five years of age and between ten and forty years, but a fall in that between the ages of five and ten and from forty years upwards ; but the increase in the one case was in excess of the decrease in the other, so that the total death-rate for all ages during 1897 exceeded that of 1896. The figures are as follows :—

Year.	Under 1 year.	1 to 4 years.	5 to 9 years.	10 to 19 years.	20 to 39 years.	40 to 59 years.	60 years and upwards.	Total.
1896	435·4	50·4	22·3	17·1	24·2	28·5	74·0	35·7
1897	458·5	58·3	21·8	17·7	26·2	26·6	69·3	36·1

The mortality of infants under one year of age during 1897 was extremely high, and though below the figure of 1895 exceeded that of 1896. There were 4,491 deaths, being a mortality of 356·5 per 1,000 births. The mortality was much greater in the urban than in the suburban area of Calcutta, being 379·7 against 320·3 per 1,000 ; and it was greater in males than in females, and was, as usual, greatest among the Mahomedans and least among the Christians.

The subject acquires a really serious import when one compares the statistics of infant mortality in Calcutta during the past few years, as in the following table :—

Year	1897	Mean of previous 5 years	1896	1895	1894	1893	1892
Death-rate per 1,000 infants under one year of age.	458·5	422·0	435·4	476·0	402·4	415·4	383·9

These figures serve to show that not only was the infant mortality in 1897 in excess of the average of the previous five years, but, what is perhaps of still greater consequence, that the mortality among infants has been almost steadily increasing since 1892. The alarming state of things disclosed by these statistics calls for speedy attention from the sanitary authority of the city. In the report submitted by the late Health Officer, Dr. Simpson, on the health of Calcutta for the year 1895, attention was drawn to the highly insanitary condition of Calcutta implied in the figures of its infant mortality ; and as the subject is one which should not be lost sight of the remarks made by him in 1896 may with advantage be repeated.

" The high mortality among infants is a prominent and discreditable feature of Calcutta, " and urgently calls for improved sanitation in connection with the construction and " cleanliness of dwellings and the proper regulation of the milk-supply, in addition to an " improvement of the general drainage and cleanliness of the town. Though a good deal " of any improvement in the health of the infant population will, in the long run, depend " on the spread of sanitary education among the masses and particularly among the female " section of the community, a considerable part of it lies within the range of public " hygiene ; and this particularly applies to the laying down of proper rules and regula- " tions for the construction of sanitary dwellings and for the control of the milk-supply " of Calcutta, to the removal of the defects in the general drainage, and to the adoption of " proper means to secure an efficient daily cleansing of the town."

With regard to measures for the removal of these insanitary conditions, it may be mentioned that the Building Commission, whose appointment by Government was noticed in the last annual report, has completed its labours and submitted its report, making definite recommendations for the improvement of the building regulations of Calcutta ; and legislation to secure the construction of sanitary dwellings has been taken in hand along with that intended to remove other sanitary defects which exist in the town. Practical measures for the improvement of the drainage of Calcutta have been adopted and are being carried out. The Commissioners have, moreover, shown a general inclination to adopt means to secure an efficient daily cleansing of the city ; and, as an earnest no doubt of what they eventually mean to do, they have already made an addition to the town cleansing establishment, and appointed a special officer responsible for its cleanliness. The cleansing establishment is, however, much below the minimum necessary for good conservancy, and the Corporation is partly dependent on hired carts and cattle for removing the refuse. The proper regulation of dairies and the milk supply of the city still remains a *desideratum*, and should be delayed no longer. In this connection the chief measures, which I think are worthy of consideration, are the setting apart of suitable localities for cowhouses in sparsely populated parts of the town, the construction or remodelling of all cowhouses and dairies on approved sanitary patterns, and the abolition of the sale of milk or its products by itinerant vendors having no fixed dairies or shops in Calcutta.

As usual, the mortality among females was higher than among males, the ratio being 42·4 to 32·9. The excess in mortality during 1897 over the average of the previous five years was due to a rise in the mortality among both males and females.

The death-rate according to nationality was lower among Christians and Mahomedans, but higher among Hindus and other classes, than the average of the previous five years. The figures for 1897 are 22·6 for Christians, 32·1 for Mahomedans, 38·7 for Hindus and

51·9 for Other Classes, against 24·7, 32·8, 34·2 and 48·5 the averages of the previous five years, respectively.

The mortality that took place in the town during the year 1897 is shown, ward by ward, in comparison with the average mortality of the previous five years in the statement subjoined. It will be observed that there has been an improvement in the public health in the European quarter generally in the old town area, the district of Waterloo Street alone forming an exception, and that a similarly satisfactory condition of the public health has been attained in the Puddopooker Ward in urban Calcutta, as well as in the added area of Shampooker and in the Baniapooker, Ballygunge and Bhowanipur wards in the suburbs, the improvement in the public health during 1897 over the previous quinquennium being most marked in the Colingah, Park Street and Ballygunge wards. On the other hand, there has been a marked falling off in the health of the native quarters of Calcutta, the deterioration being most conspicuous in Entally, the added area of Moocheepara and Burrabazar.

Statement of Deaths from different causes during 1897.

1.	2.	3.	4.	5.	6.	7.	8. Injury.					9.	10.	11. Ratio of Deaths per 1,000 of Population.							
							Suicide.													*From all Causes.*	
No. of Wards.	Names of Wards.	Population according to Census of 1891.	Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Male.	Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	All other Causes.	Total Deaths from all Causes.	Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes.	For the Year.	Mean of previous 5 Years.
	Shampooker	29,951	113	13	342	119	2	6	12	—	20	468	1,075	3·7	·43	11·4	3·9	·66	15·6	35·8	32·5
	Coomartolly	26,614	156	10	301	124	—	3	7	—	10	399	1,000	5·8	·37	11·3	4·6	·37	14·9	37·5	31·7
	Burtollah	28,374	128	6	414	110	2	5	9	—	16	454	1,128	4·5	·21	14·6	3·8	·56	16·0	39·8	35·3
	Sukea's Street	25,750	83	9	320	71	4	2	8	—	14	345	842	3·2	·35	12·4	2·7	·54	13·4	32·6	30·7
	Jorabagan	39,180	183	5	608	163	2	1	18	—	21	471	1,451	4·6	·12	15·5	4·1	·53	12·0	37·0	33·1
	Mayo Hospital	—	6	—	2	4	—	—	2	—	2	4	18	—	—	—	—	—	—	—	—
	Jorasanko	41,657	142	8	588	144	3	3	8	—	14	589	1,485	3·4	·19	14·1	3·4	·33	14·1	35·6	34·5
	Burra Bazar	20,646	101	9	303	89	5	1	9	—	15	250	767	4·9	·43	14·6	4·3	·72	12·1	37·1	30·1
	Colootollah	50,781	130	4	809	115	7	1	30	—	38	526	1,622	2·5	·07	15·9	2·2	·74	10·3	21·9	30·4
	Medical College Hospital ..	—	10	—	12	16	3	1	2	—	6	135	179	—	—	—	—	—	—	—	—
	Moocheepara	39,109	99	1	631	115	3	3	10	—	16	624	1,486	2·5	·02	16·1	2·9	·40	15·1	37·9	34·6
	Police Hospital	—	—	—	—	2	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—
	Bow Bazar	22,668	45	2	262	73	2	2	7	—	11	307	700	1·9	·08	11·5	3·2	·48	13·5	30·8	30·3
	Puddopooker	20,761	60	4	220	71	—	3	5	—	8	306	669	2·9	·19	10·5	3·4	·38	14·7	32·2	33·2
	Waterloo Street	6,083	23	—	32	12	—	—	—	—	—	41	108	3·7	—	5·2	1·9	—	6·7	17·7	15·5
	Fenwick Bazar	28,366	46	1	295	56	1	1	4	—	6	220	633	1·6	·03	10·4	1·9	·21	8·0	22·3	23·1
	Taltollah	29,207	54	2	387	65	—	—	2	—	2	330	840	1·8	·06	13·2	2·2	·06	11·3	28·4	30·9
	Collinga	13,218	17	2	173	32	—	—	4	—	4	112	340	1·3	·15	13·1	2·4	·30	8·4	25·7	31·5
	Park Street..	4,620	—	—	17	3	—	—	2	—	2	28	50	—	—	3·6	·64	·43	6·1	10·8	15·9
	Bamun Bustee	4,590	11	—	64	20	—	—	6	1	7	50	152	2·4	—	13·9	4·3	1·5	10·8	33·0	36·4
	Hastings	4,820	19	—	125	24	—	—	2	—	2	54	224	3·9	—	25·9	4·9	·41	11·2	36·3	38·0
	Total	4,36,403	1,426	76	5,905	1,428	34	32	147	1	214	5,722	14,771	3·2	·17	13·5	3·2	·49	13·1	33·8	32·0
	Fort William	3,468	2	1	9	1	—	—	—	—	—	12	25	·57	·29	2·5	·29	—	3·4	7·2	9·2
	Port of Calcutta	26,589	115	5	40	20	—	—	43	—	43	30	253	4·2	·18	1·5	·75	1·6	1·1	9·5	6·5
	Total of Urban Calcutta ..	4,66,460	1,543	82	5,954	1,449	34	32	190	1	25	5,764	15,049	3·3	·17	12·7	3·1	·55	12·3	32·2	30·4
	Added Area, Shampooker ..	6,934	37	1	122	24	—	—	—	—	—	65	249	5·4	·14	17·5	3·4	—	9·3	35·9	19·7
	Do. Burtollah	8,057	22	3	225	33	—	—	1	—	1	99	383	2·7	·37	27·9	4·0	·12	12·2	47·5	41·3
	Do. Sukea's Street ..	9,078	28	3	210	34	—	3	6	—	9	159	453	3·0	·33	23·1	4·8	·99	17·5	49·9	44·3
	Do. Moocheepara ..	10,363	43	5	171	61	—	1	11	1	13	125	418	4·1	·48	16·4	5·8	1·3	12·0	40·3	32·7

Statement of Deaths from different causes during 1897—continued.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1891.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	9. All other Causes.	10. Total Deaths from all Causes.	11. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes.	From all Causes. For the Year.	From all Causes. Mean of previous 5 Years.
	Entally	33,147	195	16	704	177	—	1	20	2	23	477	1,592	5·8	·48	21·2	5·3	·69	14·3	48·0	37·5
	Campbell Hospital	—	73	17	206	840	1	—	7	—	8	500	1,644	—	—	—	—	—	—	—	—
	Baniapooker	23,020	32	2	418	63	—	—	3	—	3	254	772	1·3	·08	18·1	2·7	·13	11·0	33·5	34·3
	Ballygunge	22,831	69	10	316	109	2	—	4	1	7	311	822	3·0	·44	14·0	4·8	·31	13·8	36·6	41·9
	Bhowanipur	42,591	160	17	540	165	4	3	9	1	17	563	1,462	3·7	·39	12·6	3·8	·39	13·2	34·3	34·9
	General Hospital	—	2	—	—	—	—	—	—	—	—	18	20	—	—	—	—	—	—	—	—
	European Lunatic Asylum ..	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
	Alipur Lock Hospital	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
	Do. Jail Hospital	—	—	—	—	2	—	—	—	—	—	9	11	—	—	—	—	—	—	—	—
	Do. Police Hospital	—	—	—	1	5	—	—	—	—	—	7	13	—	—	—	—	—	—	—	—
	Do. Police Case Hospital ..	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—
	Alipur	14,804	34	2	125	65	—	1	12	2	15	152	393	2·3	·13	8·4	4·3	1·0	10·2	29·2	27·0
	Khidderpur	15,340	20	1	289	83	—	—	7	—	7	228	628	1·3	·06	18·8	5·4	·45	14·9	40·9	36·9
	Watgunge	26,836	71	2	328	95	1	—	10	—	11	211	718	2·6	·07	12·2	3·4	·41	7·8	26·6	23·4
	Total	2,12,998	786	79	3,655	1,767	8	9	90	7	114	3,181	9,582	3·6	·37	17·1	8·2	·53	14·9	44·9	40·2
	Canal	2,102	20	—	10	2	—	—	—	—	—	2	34	9·5	—	4·7	·95	—	·95	16·1	13·5
	Total of Suburban Calcutta ..	2,15,100	806	79	3,665	1,769	8	9	90	7	114	3,183	9,616	3·7	·36	17·0	8·2	·53	14·8	44·7	39·9
	Total of Municipal Calcutta ..	6,81,560	2,349	161	9,619	3,218	42	41	280	8	371	8,947	24,665	3·4	·23	14·1	4·7	·54	13·1	36·1	33·5

In the subjoined statement is shown, under five causes or groups of causes, the mortality that took place in 1897 in comparison with that of previous years. It will be observed that, though in comparison with the year 1896, the year 1897 was characterised by a fall in the mortality from cholera, but a rise in that from all the remaining causes, still when the comparison is made either with the average of the previous five years, or with that of the preceding eight years, there has been a rise in the mortality from all causes excepting small-pox, that is to say, from the factors which habitually create the bulk of the mortality in Calcutta.

Statement of Deaths from the five principal causes in Calcutta during 1897 *compared with the mean of the preceding decade.*

Year.	Cholera.			Dysentery and Diarrhœa.			Fever.			Small-pox.			Other Causes.			Total Deaths exclusive of Still-births.			Ratio per 1,000 of Popution, Census of 1891.		
	Town.	Suburbs.	Combined.	Town.	Suburbs.	Combined.	Town.	Suburbs.	Combined.	Town.	Suburbs.	Combined.	Town.	Suburbs.	Combined.	Town.	Suburbs.	Combined.	Town.	Suburbs.	Combined.
1887	1,198	—	—	1,197	—	—	3,253	—	—	2	—	—	5,329	—	—	10,979	—	—	23·6	—	—
1888	1,734	—	—	1,056	—	—	3,198	—	—	12	—	—	5,685	—	—	11,685	—	—	25·0	—	—
1889	1,079	1 236	2,315	1,331	1,425	2,756	3,341	2,653	5,994	71	28	99	5,860	2,540	8,400	11,682	7,882	19,564	25·0	36·6	28·7
1890	963	916	1,879	1,311	1,448	2,759	4,154	2,638	6,792	700	172	872	5,254	2,812	8,066	12,382	7,986	20,368	26·5	37·1	29·8
1891	1,553	1,402	2,955	1,433	1,283	2,716	4,675	3,176	7,851	13	5	18	5,357	2,618	7,977	13,033	8,484	21,517	27·5	39·4	31·5
1892	1,257	762	2,019	1,278	1,086	2,364	4,632	2,986	7,618	16	5	21	5,491	2,667	8,158	12,674	7,506	20,180	27·1	34·8	29·6
1893	596	273	869	1,466	1,416	2,882	4,749	3,342	8,091	13	18	31	5,289	2,951	8,240	12,113	8,000	20,113	25·9	37·1	29·5
1894	1,118	577	1,695	1,586	1,550	3,136	5,712	3,251	8,963	346	59	405	5,278	2,964	8,242	14,040	8,401	22,441	30·0	39·0	32 9
1895	1,302	797	2,099	1,599	1,670	3,269	6,831	4,514	11,345	1,691	529	2,220	5,322	2,776	8,098	16,745	10,286	27,031	35·8	47·8	39·6
1896	2,377	1,072	3,449	1,451	1,516	2,967	6,075	3,489	9,564	40	29	69	5,530	2,777	8,307	15,473	8,883	24,356	33·1	41·2	35·7
Mean	1,318	879	2,160	1,371	1,424	2,856	4,662	3,256	8,277	290	106	467	5,440	2,763	8,186	13,081	8,428	21,946	28·0	39·1	32·1
1897	1,543	806	2,349	1,449	1,769	3,218	5,954	3,665	9,619	82	79	161	6,021	3,297	9,318	15,049	9,616	24,665	32·2	44·7	36·1

Small-pox.—The mortality from small-pox during the year 1897, though it exceeded the corresponding figure of the preceding year, was much lower than the average of the previous five years. The number of deaths recorded under this head amounted to 161, against 69 of the previous year, and against 469 the average of the preceding five years (1892 to 1896). Were we to exclude the 17 deaths which occurred in the Campbell Hospital among patients admitted there from places beyond the limits of Calcutta, the number of deaths that could be ascribed to Calcutta proper would be only 144. Of the 161 deaths, 82 occurred in urban and 79 in suburban Calcutta. The cases were distributed through the town, only four wards, namely, Waterloo Street, Park Street, Bamun Basti, and Hastings, being free from the disease. 103 of the cases were unprotected, 30 vaccinated, and 20 inoculated, and 1 had had natural small-pox, while in 7 cases previous protection or otherwise was not ascertained.

Cholera.—The mortality from cholera during the year 1897 exceeded that of every year since the amalgamation of the suburbs with the town of Calcutta, excepting 1891 and 1896, and also succeeded the average of the eight years from 1889 to 1896. The number of deaths was 2,349 against 2,160 the mean of the eight years from 1889 to 1896, giving a death-rate of 3·4 against 3·1 per 1,000 of the population. Of these 2,349 deaths, 1,543 took place in urban Calcutta, exceeding the mean of the preceding ten years by 225, and 806 in suburban Calcutta, falling short of the average of the previous eight years by 73. The figures for the two areas are as follow :—

—	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.
Urban Calcutta ...	1,198	1,734	1,079	963	1,553	1,257	596	1,118	1,302	2,377	1,543
Suburban do. ...	—	—	1,236	916	1,402	762	273	577	797	1,072	806
Total Calcutta ...	1,198	1,734	2,315	1,879	2,955	2,019	869	1,695	2,099	3,449	2,349

The mortality from cholera according to season is shown by the following figures :—

January.	February.	March.	April.	May.	June.
124	325	646	522	252	189
July.	**August.**	**September.**	**October.**	**November.**	**December.**
88	27	42	36	59	39

From these figures it will be seen that the heaviest mortality during the year was, as usual, in March and April. The mortality was greatest in Coomartooly, Entally and the added area of Shampooker, with death-rates of 5·8, 5·8 and 5·4, respectively, per 1,000 of the population, and was lowest in Collinga, Baniapooker and Khidderpur, with a death-rate of 1·3 per 1,000 of the population in each. One ward, namely, Park Street, was entirely free from the disease during the year. The average cholera ratio 3·4 was exceeded in seven wards of the urban area, in the extended parts of Shampooker and Coomartooly, and in Entally and Bhowanipur in the suburban area. In connection with the prevalence of cholera, bacteriological examination was made of 839 samples, mainly of water from the river Hooghly, Circular Canal, Tolly's Nullah, tanks and wells, bathing platforms, house taps and reservoirs in pumping stations ; of these, 602 samples examined during the first half-year from January to June showed the presence of *comma bacilli* in 57 or 9·4 per cent., though none of the samples of filtered water did so, while 237 samples examined during the latter half of the year gave no indication of *commas*.

In the annual report for 1896 it was stated that owing to the discovery of *comma bacilli* in a large number of the public bathing platforms synchronously with their presence in the river water opposite Calcutta and with the prevalence of cholera in the town, the supply of unfiltered water at these platforms had been considered a danger to

the public health, and it had been recommended that filtered water should be supplied to them instead. This recommendation was accepted by the Commissioners and carried into effect during the year under review.

Bowel-complaints.—The mortality from dysentery and diarrhœa was higher in 1897 than the average of the previous eight years. The number of deaths was 3,218, against 2,856 the mean of the eight years from 1889 to 1896, giving a death-rate of 4·7 against 4·1 per 1,000 of the population. Of the 3,218 deaths, 1,449 occurred in urban Calcutta, exceeding the average of the previous decennium by 78, and 1,769 took place in suburban Calcutta, exceeding the mean of previous eight years by 345.

Fevers.—The deaths from fevers during the year 1897 were in excess of those in 1896, and also exceeded the average of the previous eight years. The total number of deaths recorded during the year was 9,619 against 9,564 in 1896 and against 8,277 the mean of the eight years from 1889 to 1896, equivalent to a death-rate of 14·1 against 14·0 and 12·1 respectively per 1,000 of the population. The figures for the urban and suburban areas are severally shown in the following table :—

Year.	Urban Calcutta.		Suburban Calcutta.		Total Calcutta.	
	Number of deaths.	Death-rate.	Number of deaths.	Death-rate.	Number of deaths.	Death-rate.
1897	5,954	12·7	3,665	17·0	9,619	14·1
1896	6,075	13·0	3,489	16·2	9,564	14·0
Average of 8 years 1889–96 ...	5,021	10·7	3,256	15·1	8,277	12·1

From these figures it will be seen that, in comparison with the year 1896, there was a slight fall in fever mortality in the urban area but a rise in the suburban area, though the excess in the latter case being greater than the fall in the former, the mortality in the town as a whole somewhat exceeded that of 1896. On the other hand, in comparison to the average of the eight years from 1889 to 1896, there were 933 more deaths in urban Calcutta and 1,342 more deaths in suburban Calcutta in 1897. A glance at the annual figures for the past nine years, in fact, renders it apparent that the death-rate from fevers in 1897 is not far from being double of what it was in 1889 in the urban area of Calcutta, while it is also largely in excess of that of 1889 in the suburban area. This appears from the following figures, which also show the relation between the fever ratio and the high price and consequent scarcity of food during the past nine years :—

Deaths and death-rates from fevers in Calcutta during 1897.

Year.	Urban Calcutta.		Suburban Calcutta.		Total Calcutta.		Price of common rice.
	No. of deaths.	Ratio.	No. of deaths.	Ratio.	No. of deaths.	Ratio.	
							Rs. A. P.
1889	3,341	7·7	2,653	12·3	5,994	8·8	3 5 0
1890	4,154	8·9	2,638	12·2	6,792	9·9	3 2 0
1891	4,675	10·0	3,176	14·7	7,851	11·5	3 8 9
1892	4,632	9·9	2,986	13·8	7,618	11·1	4 6 0
1893	4,749	10·1	3,342	15·5	8,091	11·8	4 10 0
1894	5,712	12·2	3,251	15·1	8,693	13·1	4 9 4
1895	6,831	14·6	4,514	20·9	11,345	16·6	3 12 0
1896	6,075	13·0	3,489	16·2	9,564	14·0	4 14 6
1897	5,954	12·7	3,665	17·0	9,619	14·1	5 2 3

It will be observed that, with the exception of 1895, which was a specially unhealthy year in respect of fevers not only in Calcutta but in the province of Bengal as a whole, and excepting some slight variations, the death-rate has risen during the past nine years

in almost the same proportion as the price of food, giving the high ratio of 14·1 per 1,000 of the population, which is not much below half of the total death-rate in the year 1897, when food rose to a scarcity price.

Other causes.—The mortality from all other causes during 1897 exceeded that of all of the previous eight years and also exceeded the average of those years by 1,132. There were 9,318 deaths, against 8,307 in 1896 and against 8,186 the mean of the eight years from 1892 to 1896, giving a death-rate of 13·6 against 12·2 and 12·0 respectively.

Registration of births and deaths.—For the purpose of registration of births and deaths the city is divided into 25 districts, called wards, placed in charge of 25 officers called Sub-Registrars of births and deaths, who work under the general supervision of 24 Ward Inspectors. The Ward Inspectors, however, are officers entrusted with and responsible for the daily town cleansing work and the adoption of measures for the abatement of nuisances in their respective wards, and the Sub-Registrars, who are men of the sircar class, are mere indoor clerks, and have to assist the Inspectors in the clerical work connected with the town cleansing and sanitary department. This complication of duties entrusted to the same officers leads to the registration of births and deaths being ill-performed, owing to its being left mainly, if not altogether, to the discretion of the residents.

Under the local circumstances, the complete registration of births taking place in Calcutta requires that there should be an efficient organization by which all births occurring in the town should be promptly brought to the notice of the ward officers concerned. From the want of such an organization it happens that in case the parents or friends of newly born children neglect to present themselves at the ward offices, the births are rarely discovered by the registering officers, though occasionally a few such cases are detected by the Ward Inspectors, either through their own establishments or through the vaccinators and Medical Inspectors or otherwise. When unregistered cases of birth, however, are so detected, prosecution is instituted against the parties responsible for the offence. In this way 36 prosecutions were undertaken or conducted during the 12 months from 1st April 1897 to 31st March 1898, of which 32 were disposed of, with an aggregate penalty of Rs. 54–8 imposed after conviction on the offenders.

As regards the registration of deaths which take place in Calcutta, the work is better done, owing to the arrangement which exists for the supply of death returns from the chief public cremation grounds and cemeteries in the city to the death registration department of the Corporation. Although, in consequence of the corpses of persons who die in Calcutta going as a rule to those cremation grounds and cemeteries or at the ward offices, a small margin is often left of cases in which the bodies of the dead are disposed of either at places beyond Calcutta or in cemeteries in town with which no arrangement exists for the supply of death-returns. This defect ought to be removed by arranging with the owner or person in charge of every cemetery in which the bodies of persons dying in Calcutta are accustomed to be disposed of, for the registration of the deaths and the supply of returns to the Corporation.

The main defect in the registration of deaths in Calcutta, however, consists in the fact that the cause or causes to which deaths are ascribed in the death registers are, when enquired into, found in many cases to be wrong, rendering the death statistics of the town in respect of the causes of death unreliable. As stated in the annual report for the year 1891 and as may be ascertained by analysing the deaths registered during any year, more than half of the people who die in Calcutta are not attended in their last illness by a medical practitioner of any sort, while the number that are attended by qualified medical men is very much smaller, generally not exceeding 20 per cent. So that in a large majority of deaths taking place in the town the causes of death recorded in the death registers cannot be depended upon ; and even in the cases which receive qualified medical attention before death, as the production of a medical certificate before the disposal of a dead body cannot be insisted on, the causes of death recorded at the cremation grounds and cemeteries in the majority of instances depend on the mere statement of the friends of the deceased.

Cremation grounds and cemeteries.—The disposal of corpses is carried on in Calcutta indifferently by day or night, specially as regards the cremation of Hindus. There are 3 public cremation grounds and 1 public cemetery for Hindus, 4 public cemeteries for Mahomedans, 4 for Christians, and 1 for Jews, where either officers called Sub-Registrars are employed by the Corporation for the registration of deaths or an arrangement exists with the registering officers in charge for the supply of weekly death returns.

Of these the cemeteries for Christians and Mahomedans are in charge of two Burial Boards appointed by Government, both of which have the Chairman of the Corporation for their President; while the three cremation grounds and one cemetery for Hindus are in charge of the Corporation.

There are, however, many places in Calcutta for the disposal of the bodies of persons dying in the town, which are owned by and are in charge of private individuals, and which are used either as family burial grounds, or as cemeteries for special small communities. There is at present no proper arrangement to ensure that every case of burial taking place in these cemeteries will be invariably registered and timely reported to the Corporation, though the number of burials taking place in them annually is very small, and some of them have even no burial at all for a year or more. This defect in respect of registration of deaths in private burial grounds and supply of returns to the sanitary authorities of the city needs rectification as early as possible.

For the convenience of the Hindu public the rates fixed for the supply of fuel and other necessaries of cremation were reduced in the course of the year under report. Four public Mahomedan cemeteries, moreover, were closed as unfit for further burials, and a new one, called the Gor-i-Ghariban, was opened at 32, Gobra Road. Steps were also taken to acquire a plot of land for a new Mahomedan cemetery to serve the northern part of the town. The owners (three) of one of the old Mahomedan cemeteries which had been closed were prosecuted for permitting illicit burials to take place there, and one of them was twice convicted and fined. Fifty-one persons who buried corpses in the cemetery were also prosecuted and were convicted and fined in amounts varying from Rs. 2 to Rs. 10 each. But, as in spite of these measures clandestine burials continued, and the owners pleaded their inability to prevent them for want of guards, special guards have recently been appointed at their expense for the detection of illicit burials which may take place there. This case shows the necessity for public cemeteries, like cremation grounds, being placed under the direct authority of the Corporation or of some responsible constituted body like the Christian or the Mahomedan Burial Board. It also seems to me that no cemetery of any sort which is not under the immediate control either of a special Board appointed by Government or of the Corporation should be allowed to exist in Calcutta, and that, to meet the wishes of those who might prefer to have places for the exclusive use of themselves and their relatives and friends for the disposal of corpses, special plots might be set apart in every public cemetery kept open in the town.

Vaccination.—Vaccination against small-pox was carried on as usual by the vaccination department of the Health Officer during the year 1897; and owing to the prevalence of small-pox in the town, as well as in Howrah and adjacent places, a much larger number of operations were performed during the year than in the previous year. The total number of persons vaccinated was 21,620, against 11,976 in the previous year. Of these, 13,297 were primary operations and 8,323 were cases of re-vaccination, against 9,450 and 2,526 respectively in 1896, thus showing an increase of 3,847 primary vaccinations and 5,797 re-vaccinations.

Besides the above numbers, which show the work done by the vaccination department, under the Health Officer, 97 primary vaccinations and 2,898 re-vaccinations (so far as ascertained) were performed by Government officers of the Animal Vaccination Depôt, Calcutta, in private European houses and in public institutions (such as hospitals, jails, asylums, &c.). These figures have not been included in the Health Officer's vaccination returns, and are stated here merely to show that a considerable number of persons, mainly Europeans, find it convenient to have vaccination done by others than the vaccination officers under the Health Officer. Were these figures, however, combined with those shown in the returns of the Health Officer, the total number of primary operations done in Calcutta during the year 1897 would amount to 13,394 and the number of re-vaccinations to 11,221.

Of the 13,297 primary operations performed by the Health Officer's establishment, 12,308, or 92·56 per cent., were successful, 283, or 2·12 per cent., unsuccessful, and 20, or 0·15 per cent., were doubtful, while in 686, or 5·15 per cent., the result could not be ascertained. The rate of success calculated on the ascertained cases was 97·59 per cent. Of the 8,323 re-vaccinations 912, or 10·95 per cent., were successful, 3,455, or 41·51 per cent., were unsuccessful, and 1,156, or 13·88 per cent., were doubtful, while in 2,800, or 33·64 per cent., the result could not be ascertained. Calculated on the ascertained cases, however, the rate of success in the re-vaccinations was 16·51 per cent.

Of the total of 21,620 persons vaccinated 12,814 were males and 8,806 females; and according to nationality 14,224 were Hindus, 4,883 Mahomedans, 2,400 Christians and 113 of other classes. Considered according to age 4,467 of the vaccinated were under 1 year, 8,622 were 1 year and under 6 years, and 8,531 were 6 years and upwards.

Of the 13,297 primary operations performed in 1897, 9,201 were Hindus, 3,601 Mahomedans, 416 Christians, and 79 other classes; while 4,467 were under 1 year of age, 5,982 were 1 year and under 2 years, 2,317 were 2 and under 6 years, and 531 were 6 years and upwards.

Primary vaccination is carried on in Calcutta under the Compulsory Vaccination Act, which provides that the parent or guardian of a child is to get it vaccinated within one year from birth, and that if on the expiration of that year the child is found unvaccinated, the parent or guardian may be prosecuted and an order obtained from a Magistrate for the compulsory vaccination of the child. The procedure accordingly adopted is for the Registrar of Births, at the time of registration of a birth, to issue a notice to the parent or guardian of the child to get it vaccinated within 12 months from the date of birth, and to send a corresponding notice of the birth to the vaccination department; and for the vaccination department, as soon as possible after the child has been vaccinated, to grant to its parent or guardian a certificate showing the result of the operation, and to send a corresponding certificate to the Birth Registrar for record. When twelve months have elapsed from birth, if the child is found unvaccinated, though in a fit state to be vaccinated, prosecution is instituted against the parent or guardian. Under the powers conferred on the vaccinators by the Amended Vaccination Act, moreover, house-to-house enquiry is made for unprotected persons by the male and female vaccinators of the department, and for every person over one year of age who is found unprotected and who or whose parent or guardian refuses to have vaccination done, a notice is issued to have the operation performed within 15 days from the receipt of notice, and, in default, the party responsible is prosecuted.

The residents mostly have a disinclination to have their children vaccinated until they are at least a year old; and the Vaccination Act gives them an undesirable latitude in this respect. Hence it happens that of the children born in Calcutta during any year only a certain number are vaccinated in the course of that year, while the balance that remain available for vaccination have to be dealt with during the year following; and as a considerable proportion of the population of the town of all ages is floating in character, some of the children born in Calcutta that have not been vaccinated or have not died during the first year of birth totally escape vaccination, either by removal from the town or by their whereabouts being not traceable after twelve months, by which time the children born in the town and those of the same ages imported from elsewhere have become mixed together, rendering differential enquiries extremely difficult. There are, however, no data available from which the proportion of children under 1 and 2 years leaving or coming to Calcutta can be even approximately estimated.

Of the 12,608 children born in 1896 4,265 died in that year, leaving 8,343 available for vaccination. Of these 8,343 children 2,936 were vaccinated during 1896, thus leaving a balance of 5,407 at the beginning of 1897. This figure, 5,407, when compared with 5,982, the number of children between 1 and 2 years of age actually vaccinated during 1897, and specially when due allowance has been made, first, for the number that died in 1897, and, secondly, for those of the same age that came into or left the town during the same period, serves to shew that few of the children born in Calcutta during the year 1896 have escaped vaccination. Although the protection of the infant population, so far as the children born in Calcutta are concerned, cannot be considered altogether unsatisfactory, that protection takes two years' time for its accomplishment; so that a large proportion of the population remains unprotected for over a year from birth. This defect in the due and early protection of the infant population of Calcutta can be only remedied by a reduction of the period from birth during which compulsory vaccination cannot be legally resorted to.

Vaccination was performed during the year 1897 mainly with lymph obtained direct from vaccinated calves, of which the department received a supply of 566 in the course of the year from the Government Animal Vaccination Depôt in Calcutta. But in some cases, and specially in vaccination done among the poor at their own homes, lanoline paste obtained from the same source was made use of for convenience; and in a few cases humanised lymph was employed when people objected to vaccine taken from calves. The following table shows the comparative rates of success in primary vaccination obtained

from the use of direct calf lymph, lanoline calf lymph and humanised lymph, respectively :—

—	Direct calf lymph.	Lanoline paste.	Humanised lymph.
Total No. vaccinated	10,081	2,400	816
No. in which result was ascertained	9,786	2,014	811
Rate of success per cent. on ascertained cases	97·32	98·01	99·87

The low percentage of success obtained with vaccination from calf to arm compared with that with preserved lanoline paste is difficult to account for unless some of the calves used had passed the period of greatest efficacy, as in my experience the use of lanoline paste necessitates more excoriation and more rubbing in than lymph direct from the calf.

Anti-choleraic inoculation.—Inoculation according to Professor Haffkine's method as a preventive against cholera was practised on persons who voluntarily submitted to the operation during the first three months of the year 1897, after which the Corporation discontinued the grant for the purpose. 573 inoculations were done from the beginning of January to the end of March.

ABSTRACT OF THE REPORT OF THE MADRAS MUNICIPALITY FOR 1897-98.

(*Colonel Sir G. M. J. Moore, C.I.E.*)

Drainage.—The drainage works at Mylapore in connection with the new drainage scheme for the city, which had been undertaken in 1896-97 were in progress, and was expected to be opened shortly. The pipes required for the Sydenham and Ice House roads were obtained during the year and the work will be commenced next year.

Water-supply.—During the year, 1,864 yards of pipes were laid and 26 fountains were erected, against 20,169 yards of pipes and 96 fountains in 1896-97. The total number of fountains at the end of the year was 1,168, being at the rate of one for every 299 inhabitants in the water-supply area. The total quantity of water supplied to the town was 479,789,325 cubic feet, exceeding that of the previous year by about 6 per cent. The quality of the water in the Red Hills Lake was again found on analysis to be "bad," still the water as distributed after filtration was pronounced "usable." Plans and estimates of a new scheme for the water-supply of the city were under preparation by the Municipal Engineer.

Vaccination.—The total number of cases vaccinated during the year 1897-98 was 33,082 against 27,021 in 1896-97, showing a large increase of 6,061 cases; and the increase was chiefly due to the prevalence of small-pox in an epidemic form during the latter part of the year under review. Out of 33,082 cases vaccinated there were 19,264 males and 13,818 females. Of the total vaccinated 30,426 were successful, 1,018 unsuccessful and 1,638 unknown. When compared with the previous year there was an increase of 474 unknown cases in 1897-98 and this was due to the large number of re-vaccinations done among prisoners of the Jails, Emigration Coolies, &c., who were released, rejected or embarked on board the ship before the result of the operation could be ascertained.

During the year 1897-98, 1,991 cases voluntarily resorted to the Vaccine Depôts for the inspection of the Vaccinator, and in 24,410 cases the results were verified by the Divisional Vaccinators under bye-law 11, and after inspection certificates of success were issued to the parents or guardians at their own houses. These results were again inspected by the Deputy Inspector and 4 Assistant Deputy Inspectors. Those cases vaccinated in the Penitentiary, Civil Debtors' Jail and Natal Emigration Depôt were verified by the Deputy Inspector. Out of a total of 33,082 cases vaccinated 14,921 cases were inspected by these Officers and the failure to verify 50 per cent. was due to the vaccine staff having been specially engaged in checking the widespread of small-pox in February and March 1898 and in bringing the unprotected under the influence of vaccination. It would appear that in those two months 8,760 cases were vaccinated, the average monthly number being 2,200 cases.

Under the revised vaccine bye-laws sanctioned by the Government and finally published in the *Fort St. George Gazette*, dated 22nd February 1898, the parents are bound to produce the vaccinated children at the Depôts for the inspection of the Vaccinators. These bye-laws were put in force from 1st April 1898.

The percentage of success in primary and re-vaccination excluding the unknown cases from the total was 96·76 against 95·96 in 1896-97 showing a small increase of ·80 per cent. due to the large number of cases vaccinated during the year in consequence of the prevalence of small-pox in the city.

Out of 33,082 cases vaccinated 1,938 were Europeans, East Indians and Native Christians, 2,781 Mahomedans, 28,355 Hindus and 8 other castes. Of the total vaccinated 24,828 were primary vaccinations against 19,193 in 1896-97 showing an increase of 5,635 cases. The percentage of success in primary vaccination was 99·56 against 99·19 in 1896-97 showing an increase of ·37 per cent. There were 8,254 re-vaccinations among adults with a percentage of success of 86·97 against 87·11 per cent. in 1896-97 showing a small decrease of ·14 per cent. As regards the high

percentage of success obtained in re-vaccination, Government in their order No. 2201 M., dated 11th October 1897, required the Health Officer to inspect 1,000 cases as a test and report on the result obtained. The late Health Officer Dr. J. Nield Cook verified 365 cases and recorded his result so far and before he could complete 1,000 cases he left Madras for Calcutta. Dr. J. W. Cornwall Health Officer, has taken up the work of inspecting 1,000 cases after entering upon his duties and the results will be reported in due course. The following statement shows the result obtained in both primary and re-vaccination :—

Year.	Primary Vaccination.				Revaccination.			
	Successful.	Percentage.	Unsuccessful.	Unknown.	Successful.	Percentage.	Unsuccessful.	Unknown.
1896-97	18,789	99·19	153	251	6,024	87·11	891	913
1897-98	24,335	99·56	106	387	6,091	86·97	912	1,251

The number of infants vaccinated under one year of age was 15,323 children against 13,129 in the previous year showing a large increase of 2,194 cases with a percentage of 99·70 of success against 99·36 in 1896–97. Among children above one and under six years the number vaccinated was 8,771, and among those above six years 8,988 were vaccinated.

Vital Statistics.

Births.—The total number of live-births registered during the year 1897, amounted to 18,702 against 18,684 in 1896 showing a small increase of 18. The ratio per 1,000 per annum calculated on the census population of 1891 was 41·3 against 41·2 of the previous year. This increase though very small must be viewed with satisfaction, considering the distress induced by famine which was felt in the town as well as in the Presidency. The birth-rate of a population being directly influenced by its prosperity and adversity, it would not have been surprising if a considerable reduction in the birth-rate had occurred. The number of still-births registered during the year 1897 amounted to 410 being 2·2 still-births to 100 live-births. The ratio is unquestionably too low for a city like Madras and it can only be explained by the fact that a number of still-births are not recorded as such or that such births are entirely concealed. The latter seems the more probable of the two, seeing that the Hindus have a prejudice against burying their first-born in a public burial ground. The male births numbered 9,422 and the female 9,280, giving a proportion of 101·5 of males to 100 of females.

According to caste the birth-rate among the Mahomedans was 43·1 per 1,000, among the Hindus 41·6, and among the Christians 36·2.

Mortality.—During the year 1897 there were 16,086 deaths registered in Madras, giving a death-rate of 35·5 per 1,000 calculated on the census population of 1891, against 17,131 or a ratio of 37·8 in the previous year, the average for the decade being 17,987·5. Of the 16,086 deaths registered, 7,953 occurred among males and 8,133 among females, giving a proportion of 97·7 to 100.

The number of deaths according to nationality was Europeans 108, Eurasians 366, Native Christians 709, Hindus 12,833, Mahomedans 2,062, and others 8. The ratios per 1,000 are 29·7 among Christians, 35·7 among Hindus, 38·7 among Mahomedans and 13·4 among "others" against 31·2, 37·9, 42·5 and 13·4 of the previous year.

There was a decided fall in the number of death from Fevers during the year under report from 6,039 in 1896 to 5,484 in 1897. A like fall also occurred in Measles and Diarrhœa and Dysentery from 494 to 410 and 2,353 to 2,000. But the mortality from Small-pox rose from 42 to 114, highest since 1884, and that from Cholera from 97 to 169, highest since 1892.

Small-pox and measures adopted for its prevention.—The total number of deaths registered in 1897 from small-pox was 114 against 42 of the previous year and the number of attacks reported in 1897 was 238. The small-pox of 1897 was a

continuation of that which commenced in the beginning of 1896. The incidence on the vaccinated and unvaccinated is shown in the following table :—

—	Attacks.	Deaths.	Fatality.
Unvaccinated	149	91	61·0
Said to be vaccinated but no marks ...	44	13	29·5
Vaccinated	44	10	22·7
Had previous attack of small-pox ...	1	—	—
Total ...	238	114	47·9

—	Total deaths.	Under 10 years.	10–20.	Over 20.
Unvaccinated... ...	91	82	6	3
Vaccinated	10	5	1	4

The tables clearly indicate the protective influence of a single vaccination so far as the mortality amongst the attacked is concerned :—Vaccination was vigorously pushed in infected localities, house to house inspections were made and the unprotected were vaccinated. Re-vaccination was encouraged in public institutions. Sanitary Overseers promptly disinfected the houses of the Small-pox cases and destroyed the bedding and clothes of the patients. Endeavours were made to isolate patients who had insufficient accommodation in their houses in Small-pox Hospitals.

Cholera.—The mortality from Cholera was above the average of the previous 4 years. The number of deaths registered was 169 against 97 of 1896 and 80·75 the average of the four previous years. The mortality from cholera was as usual greatest in 1st Division where alone 59 deaths occurred, giving a ratio of 0·8 per 1,000. Of the 169 deaths, 36 occurred in the 1st quarter, 5 in the second, 96 in the third and 32 in the fourth. The increase in the number of deaths in the third quarter appears to have been due to the importation of the disease from Periapalayam and Conjeeveram into the city.

During the year two deaths occurred from plague—the first case was imported from Poona, and the second was the result of direct inoculation from the first at the post-mortem. A full history of these cases is given under Plague Prevention.

Measles.—The number of deaths registered from measles was 410 against 494 of the previous year, but it was considerably above that of 1894 and 1895 when only 190 and 249 deaths were registered.

Fevers.—Excluding other causes by far the largest number of deaths is recorded as due to Fevers. The number of registered deaths attributed to Fevers in 1897 was 5,484 or 555 deaths less than the previous year. As in the previous years, the highest number of deaths from fevers, 1,158 was recorded in the 1st Division, with a death-rate of 16·1 from fevers alone. Until adequate provision is made, for effective drainage the proper disposal of dead bodies and refuse of all kinds, the supply of wholesome water and other sanitary requirements of prime importance, any great reduction in the fever death-rate cannot be expected.

Bowel Complaints.—Under the heads of Dysentery and Diarrhœa there were 1,496 and 504 deaths registered in 1897 against 1,721 and 632 of 1896. There was a steady fall under this head since 1892.

Infantile Mortality.—There was a decided fall in the rate of infantile mortality during the year under report, from 407 deaths to every 1,000 births of 1896 to 369·6, deaths to every 1,000 births of 1897. This though gratifying is still very high compared to the rate in British towns. This can only be accounted for by the general ignorance of the masses in matters relating to management of birth and infancy coupled with the existence of insanitary conditions and aggregation in most parts of the town. The total number of deaths for the year registered under this head was 5,052 against 5,570 of last year.

Plague Prevention.—As in last year, so in the year under report the precautionary measures adopted against this disease have formed an important feature of the administration. In addition to the staff consisting of 1 Hospital Assistant, 1 Special Sanitary Inspector, 2 Overseers and 2 Peons maintained last year, 4 additional men were engaged under the name of " Plague men " to be sent with persons who give no clear addresses at the platforms to find out their exact residences. As the huts in paracheries have no door numbers such a procedure was found to be necessary. The usual procedure of observing for ten days all the arrivals from outside the Presidency was continued. Eight Hospital Assistants were entertained during the year with a view to examine dead bodies at burial grounds to find out the causes of deaths that occur daily in the city. This was found to be impracticable, as such a procedure cannot be undertaken without special legislation on the point empowering the medical men to demand examination of dead bodies. Their services were in consequence utilized in times of cholera and small-pox by deputing them to generally assist the Sanitary Inspectors in adopting the preventive measures to the spread of these diseases. The Royapuram Regimental Hospital and Egmore Women and Children's Hospital were fitted up to receive and treat cases of plague if any occur.

During the year a case of plague was imported into the city from Poona. The syce of a gentleman, who returned to Madras after Poona races, was taken ill with fever on the third day of his arrival and he was removed at once to the General Hospital where the case was diagnosed to be one of plague. On the receipt of this information the building where the patient lived previous to his removal to the hospital was vacated and was thoroughly disinfected. All the occupants of the house were removed to the segregation camp and observed for ten days.

Unfortunately continuing upon this case another fatal case occurred from direct inoculation at the post-mortem. This was one of the toties of the General Hospital. The residence of this toty—a hut in Pudupet hutting ground, was burnt down and fenced round and the occupants of the hut were segregated and observed. A probationary Overseer and the Assistant Health Officer inspected the hutting ground for 10 days making house to house visitations to find out if any new cases occurred.

ABSTRACT OF THE REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1897-98.

(*W. L. Harvey, Esq., Acting Municipal Commissioner.*)

SPECIAL DRAINAGE.—*Unfinished Works.*—The progress of these is described below, the names of the works being printed in italics. The *Colaba Sewerage Works* were completed at a total cost of Rs. 8,21,010, only Rs. 3,848 being spent in the year of report. On the *Umarkhadi Sewerage Works*, which were also completed, Rs. 61,871 were expended in the year, bringing up the total expenditure to Rs. 3,52,239. The *Parel Sewerage Works* (*gravitation portion*) were completed at a total cost of Rs. 62,081. The *Mazagon Sewerage Works* (*gravitation portion*) were very near completion, the total amount expended on them being Rs. 2,55,569 out of the sanctioned grant of Rs. 3,32,661. The *Malabar Hill and Khamballa Hill Sewerage Works* (*gravitation portion*) were practically completed in January 1897, and the final accounts were certified and passed in September 1897 at Rs. 1,08,552 for the total cost. The amount spent on *House Drainage Connections* (*street portions*) *in the Colaba District* was Rs. 6,866 on making 189 connections. *The Fergusson Road and Chinchpoogly Sewerage Works* were completed at a cost of Rs. 85,361, and the work of *Draining Stormwater from roads around Mahaluxmi Dhobiwada* at a cost of Rs. 1,156. The laying of a *9-inch pipe drain for the carriage of storm-water to the sea from the southern part of Wodehouse Road* cost Rs. 1,992. A *12-inch Stoneware Pipe Sewer from the Emergent Reservoir at the Wellington Fountain to the Manhole in Apollo Street opposite the Dockyard* was laid at a cost of Rs. 3,189.

New Works.—Among the principal works completed were:—The Old Race Course sewerage works (gravitation portion); the improvement of roadside drains and provision of water gullies in the Khetwadi District; avoiding side drains in Girgam Road and Pathan Street; storm-water drains in Rampart Row, Wodehouse Road, Lower Colaba Road, Thomas Street, and the eastern foot of Wodehouse Bridge; and an arched masonry drain between Gilder Lane and the B. B. & C. I. Railway. The principal new works which were still in progress at the end of the year are:—A masonry drain from Girgam to Back Bay; a storm-water drain from the Wellington Fountain to the sea; and the improvement of roadside drains and watercourses in and about Dadar Road.

Other Drainage Works.—Arrangements were made during the year for starting the following important works sanctioned by the Corporation, the first of which is expected to be completed by the 31st March 1900:—Machinery for the sewerage of the Parel, the Old Race Course, the Malabar Hill and Khambala Hill, the Elphinstone Reclamation and the Fergusson Road and Chinchpoogli Sectional Districts (on Shone system, Rs. 8,77,625; Mazagon District (sectional), Rs. 3,30,072.

The Colaba Air Compressor Station.—This station and the ejector stations working in connection therewith worked satisfactorily during the year without any serious stoppage or breakdown.

DRAINAGE.—*The Love Grove Pumping Station* was maintained in a state of efficiency throughout the year at a total cost of Rs. 88,026-5-9, the Worthington engines continuing to give satisfaction. The station enjoyed complete immunity from plague in spite of some of the men frequently coming into contact with the sewage which might be supposed to contain active bacilli.

House drainage connections.—The existing house-connections of 98 premises in Mandvi District were put into proper working order at the expense of the house-owners. The drainage fittings of 107 houses in Mandvi and 259 other houses in other localities in which plague cases had occurred were treated at a cost to the owners of Rs. 50,059-0-6. The house drainage connections of 27 houses in Kalachowki Road were made at the house-owner's expense. In 43 other houses in various parts of the City the sanitary arrangements were remodelled. Besides the street portions of house drainage connections in Colaba executed by the Special Drainage Department, 614 connections were made in various parts of the City at a total cost of Rs. 44,390.

Electrolized Sea-water.—The plant for providing electrolized sea-water put up in 1896–97 at Carnac Bunder night-soil depôt at a cost of Rs. 23,800 was worked during some portion of the year of report, but without any decisive results, the Executive Engineer not being yet in a position to state conclusively how the fluid produced compares in efficiency and cost with other disinfectants. The cost of working and maintaining the plant up to the end of the year was Rs. 1,135.

WATERWORKS.—*Tansa Lake.*—The rainfall for the year was 104·82 inches, against 120·13 and 92·37 inches in 1896 and 1895 respectively. The heaviest fall was on the 7th August, when 7·95 inches were registered. The lowest water level was 393·19 T. H. D. on the 17th June 1897. The lake overflowed on the 18th July 1897 after 35·38 inches of rain had been registered, and ceased to overflow on the 24th September 1897. The storage above lowest outlet on the 1st October 1897 was 18,559 millions of gallons, and on the 31st March 1898 it was 12,396 millions of gallons, showing a consumption of 6,163 millions of gallons in six months, or 34·05 millions of gallons per day, including evaporation, absorption and leakage. The quantity of water passed over the waste weir is estimated at 26,403 millions of gallons. The approximate quantity of water passed from the duct at the Ghatkoper syphon head for the year amounted to 7,275 millions of gallons. About 213 millions of gallons of water passed into the Vehar Lake against 165 and 88 millions of gallons during 1896–97 and 1895–96 respectively. The daily average of the quantity supplied to the City and delivered into Vehar was consequently about 20½ millions of gallons a day, leaving about 13½ millions a day for leakage, absorption and evaporation in the lake and the duct.

A sum of Rs. 62,115 was sanctioned for repairs to the portion of the embankment from Godowli to the north of the Bassein creek No. 3, and a greater part of it was completed by the end of the official year.

Vehar Lake.—The rainfall for 1897 was 97·56 inches, against 109·81 and 82·81 inches for 1896 and 1895 respectively. The lake overflowed on the 8th August 1897, and ceased to do so on the 7th October 1897. The heaviest fall was 7·56 inches on the 16th July. The lowest water-level was 251·71 T. H. D. on the 16th June 1897. The storage on the 1st October 1897 was 11,425 million gallons ; on the 31st March 1898, 8906 million gallons ; the total consumption of water from the lake during the dry months from 1st October 1897 to 31st March 1898 was 2,519 million gallons, equivalent to 13·9 million gallons per day in addition to 213 million gallons drawn from Tansa. Between the 7th August and 8th October 1897, 1,098 million gallons of water were received from Tulsi Lake by overflow. The quantity that passed over the Vehar waste weir between the 8th August and 7th October was 4,287 millions of gallons.

Tulsi Lake.—The rainfall of 1897 was 118·66 inches, as compared with the previous two years, 1896 and 1895, when it was 139·52 and 100·40 inches respectively. The heaviest fall was on the 8th August 1897, being 7·76 inches. The lowest water level was 435·00 T. H. D. on the 17th June 1897. The lake overflowed on the 7th August 1897, and ceased to overflow on the 9th October 1897. The storage on 1st October 1897 was 2,305·6 million gallons ; on the 31st March 1898 it was 1,304 millions. The total volume of water drawn from the lake during the six dry months from the 1st October 1897 to 31st March 1898 was 1,001 million gallons, or 5·5 million gallons per day, allowing 4½ millions for supply and leaving about 1 million for leakage and evaporation.

Pawai Lake.—The water supply from this lake was not required. The pumping plant remained in charge of the Assistant Engineer, Mechanical Branch.

Bhandarwada Reservoir.—The expenditure for the work of covering storage basin and construction of filters over it during the year was Rs. 1,23,084–7–4. The work of pointing the four walls and paving the floor of the storage reservoir with Indian patent stone was completed by Messrs. Garlic & Co., at a cost of Rs. 23,086–0–9.

Malabar Hill Reservoir.—Filters Nos. 2, 3 and 4 have had some alterations made in their outlet arrangements and are now in process of being recharged with filtering materials.

Distribution and maintenance.—A large quantity of water was used during the year under report, also for flushing the drains and gutters on account of the prevalence of plague, and 327 house-connections were cut off and replaced by 246 stand-pipes in convenient positions. The number of bursts during the year was 109 against 180 last year and 255 in 1895–96. Exclusive of the connections cut off on account of the plague,

365 services were disconnected on account of demolition of buildings, non-payment of rates, &c. There were 2,209 meters in use on the 31st March 1898, being an increase of 162. The consumption registered by meter aggregated a little over 1,253 million gallons.

Public Health.

The state of the public health during the year under review was very unsatisfactory. The mortality was 14,445 more than in the preceding year. The total number of deaths from all causes amounted to 47,896, equal to a death-rate of 58·28 per 1,000 of population, calculated on a population of 821,764 (census of 1891). The average number of deaths for the previous five years amounted to 28,609, or a death-rate of 34·81 per 1,000 of population.

The number of deaths according to place of birth was as follows :—

Born in Bombay	16,191
Born elsewhere and unknown	31,705

Cholera.—The number of deaths from cholera was 1,265, being 775 more than in the preceding year. The sections of the greatest mortality were Byculla, Tarwady, Parel, Mahim, Worlee, 1st Nagpada, Middle and Lower Colaba, being 3·50, 3·33, 3·13, 2·97, 2·74, 2·60 and 2·42 per 1,000 of population. The highest death-rate by caste was amongst Hindu low-castes, Native Christians, Lingaets, Brahmins, Jains, Mussalmans and Jews.

Small-pox.—The deaths from small-pox were 57, being 644 less than in the preceding year. The rate of mortality was highest amongst Hindu low-castes and Mussalmans. The mortality was highest in 1st Nagpada, Kamathipura, 2nd Nagpada and Byculla.

Measles.—There were 359 deaths from measles, being 118 more than in the last year. Of these, 274 occurred in the first four years of life. The highest mortality was amongst Hindu low-castes and Mussalmans. The death-rate was highest in 2nd Nagpada, Byculla, Tardeo, Kumbharwada, Khara Talao and Kamathipura.

Fevers.—There were 6,951 deaths from fevers, being 1,825 less than in the last year. The death-rate was highest in the districts of Parel, Sewree, Kamathipura, 2nd Nagpada, Byculla, Tardeo and Mahim. The greatest mortality was amongst Negro-Africans, Hindu low-castes, Budhists, Mussalmans, Lingaets and Hindus of other castes.

Leprosy.—There were 63 deaths from leprosy, being 9 more than in the preceding year.

Plague.—There were 11,003 deaths from Plague. Detailed particulars of this disease have been given by the Executive Health Officer in his report.

Births.—The number of births registered, exclusive of still-born, was 9,336, or 6,554 less than in the last year. Of these, 4,903 were males and 4,433 females. The diminution in the number of births was probably due to the exodus of people on account of the prevalence of the plague. Excluding Negro-Africans, the birth-rate was highest amongst Hindu low-castes, Jews, Parsees and Eurasians. The sections giving the highest birth-rate were Mahim, Byculla, Upper Colaba, 2nd Nagpada, Khetwady, Fort Northern, Tardeo, 1st Nagpada, Mazagon and Worlee.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1897.

(*Brigade-Surgeon-Lieutenant-Colonel T. S. Weir.*)

Before examining the mortality, it is well to consider the position of Bombay. The portion of Bombay in which most of the population live in closely built houses and densely populated habitations lies in a valley between rocky ridges, the centre of the valley in places lying below mean sea level; on the south side most open to the sea, and raised above the sea level by sand and alluvial deposits. Up the valley, in between hillocks, at one time flowed creeks. These creeks and the hollows have been largely filled with vegetable matters which have not at depths yet decomposed. There is still underground an ooze, where these creeks flowed, and the ground waters of the valley are influenced by the pressure of the sea currents around.

The valley of Bombay is most unfavourably situated. Into it flows the rain water from higher lands, the escape of which is obstructed by roadways and buildings, and to the north by a dense clay formation. But happily the soil has a marvellous power of purification, even greater than the air. In the centre of the valley to which most of the drainage flows, the soil is a stiff clay.

The area of Bombay is about 22 square miles, and on a portion of this area there is the most densely crowded population in the British Empire, the six sections of greatest density of population having 227,021 people on an area of 403·28 acres.

The following table shows the sections of the greatest density and their populations :—

	Population.	Area.	Persons to an acre.
Khara Talao	27,035	40·33	670·39
Chukla	32,197	51·23	628·47
Kumbharwada	32,209	52·23	616·67
Market	44,751	83·63	535·10
Bhuleshwar	38,363	71·73	534·82
Umarkhadi	52,466	104·13	503·85
	227,021	403·28	—

In 1895, before the appearance of Plague, Bombay was more healthy than any large city in India, and the chances of life were better than in many European towns. I need not do more than refer to the high mortality in Bombay one hundred years ago, when residence in it was regarded with apprehension.

It is forgotten that this city has grown so rapidly that all the improvements that other cities have had centuries to complete are not to be accomplised in Bombay in a few years. Few people realise the enormous improvements that have been effected in the last twenty years, whether it is in the highways, or in the habitations of the people, or in the reclamation and improvement of the surface ground.

The course of the epidemic of Plague is marked out in the diagram (not reproduced) of the mortality from day to day, and it may be divided into five periods of five epidemics, so to speak—

I. Commencing on the 19th September 1896 and ending about the 15th of October.

II. Commencing after the 15th of October and ending about the 4th of November.

III. Commencing after the 4th of November and, after a series of repressions, developing into the great epidemic which culminated in a high mortality on the 28th of December, and reached its greatest intensity and virulence about the 15th of January 1897.

IV. Commencing in the second week of July 1897, and reaching its maximum in the second week of August, and declining till it reached its minimum in the middle of November.

V. Commencing in the second week of December 1897, and gradually developing into the great epidemic of 1897, with slighter repressions than in the previous year, till, on the 9th of February 1898, a mortality of 347 was reached, followed by a series of repressions and fluctuations, till on the 16th of March the mortality rose to 358, and again on the 18th to the same number, from which period the mortality commenced to decline in irregular curves.

Such has been the progress of the pestilence since 1896.

There are good reasons for thinking that the epidemic might have reached its fastigium on the 9th of February 1898 if the measures, as was found advisible a month later, had been relaxed. If the concealment of cases had been less, the epidemic would have decreased sooner was the belief I expressed. An epidemic can be irritated as well as a local sore, and the period between the 9th of February and the 15th of March may be described as the period of panic and irritation. The measures were followed by the concealment of cases, and concealment led to the intensification of the type. The conditions existed which it would have been necessary to create had it been desired to intensify the disease.

Though the number of Plague cases was less than in 1896, the total mortality was higher. This implied concealment of the disease and intensification of the type through concealment. There is no better tribute to the work of the Health Department in 1896 than that in 1897, with a higher mortality, with an enormously greater expenditure, and with a vast organization—fewer cases of plague were at that period detected by the Plague Committee than by the Health Department in 1896. I admit the difficulties of the Plague Committee. The population was against them, and they had lost the assistance of the medical profession. It was difficult for them to obtain information, for the people did not call in medical men.

The view I took was this, that the future depended on—

(*a*) the multiplication of the rat population ;
(*b*) the disappearance of the disease from amongst rats ;
(*c*) the susceptibility of the human population.

Till the rats become immune, the disease must continue to occur amongst human beings wherever it has been epidemic.

In my last report I pointed out that all who came to study the disease in this city were surprised that the mortality was so low. The mortality in Bombay, having been much lower than in any place outside Bombay, deceived no doubt a great many people, and gave them an utterly wrong idea of the value of the measures being taken. They were buoyed up with a hope that it was only necessary to carry out certain measures and display various activities and the epidemic would be stayed. The pest would not be called plague if it was so easily to be defeated. This disease is concurrently epidemic amongst human beings and animals. The importance of this fact even those who came here to advise us did not comprehend—that from the earliest times far more drastic measures than have been adopted or suggested in India have been applied against the pest and have always failed to stop its progress. Until recently there was the most extraordinary ignorance as to the measures taken in ancient times to prevent the development and spread of plague.

Even in 1897, with the second recrudescence or epidemic of plague, followed by a third recrudescence, the total mortality from all causes in Bombay was not as high as the

mortality from plague alone in many places in India. In 1896 the total mortality (including plague and all other diseases) was only 40·71 per 1,000, and in 1897 it was not higher than 58 per 1,000. In places where plague has been epidemic, the mortality from this one cause has not infrequently been higher than the mortality from all causes in Bombay.

The highest mortality in Bombay from plague occurred in the suburbs, in the districts of—

——	No. of Deaths.	Death-rate.
Mahim	666	35·99
Sion	460	23·46
Kamathipura ...	619	21·19
Parel	603	20·98
Sewri	122	20·12
Byculla	919	19·38

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Cholera was but *one* of the disease causes contributing to the high mortality after June. The recognition of the types of diseases at that period was, in the opinion of experienced medical men, often attended with great difficulty. If the recognition of the type was difficult, correct registration could not be hoped for in this City, where only a small proportion of those who succumb to disease are attended in this last illness by medical men. The people—the mass of the population—had almost ceased to call in medical men when they suffered from fever. This was the most serious aspect of the effect of the measures being adopted to detect cases of plague.

In estimating the distribution of the mortality from plague by class, it has to be remembered that the mortality in some classes cannot be accepted as correct. Not only has concealment of cases to be calculated on, but imperfect recognition of the disease. The lowest mortality occurred amongst *Europeans*—20 deaths were registered. As far as the European mortality is concerned, it may be taken as correct. The mortality from plague amongst Europeans raised slightly the total death-rate in the community. The next lowest mortality occurred amongst *Musalman*—5·4 per 1,000. This cannot be accepted as correct, though the Musalman population suffered *less* than many other classes. Apart altogether from concealment, there is a margin that must be left for imperfect recognition of the disease, as only a small proportion of the Musalman sick were attended by medical men. The mortality amongst *Jews* was as low as 5·9 per 1,000. *Bhattias* had a registered mortality of only 7 per 1,000, but this cannot be considered as correct, though Bhattias did not suffer so much as other allied communities. The mortality of *Brahmins* is also low, but the total mortality in the Brahmin population is only 38 per 1,000 ; evidently a large number of cases of plague amongst Brahmins did not escape detection. It is remarkable this low mortality amongst Brahmins. Amongst *Eurasians*, allowance has also to be made for imperfect recognition of the disease. The highest mortality occurred in the *Hindu low-caste* population, and also probably the least recognition of cases.

If we take the *Parsee* community, the Plague mortality was 7·52 per 1,000. If this is deducted from the total mortality, it gives a mortality of 25, so that the increase in the mortality of the Parsee community is very nearly accounted for by the mortality from Plague. There could not, as would be expected, have been any great concealment of cases.

Up to the commencement of the work of the Plague Committee on the 1st of April, the difficulty, I would again repeat, was to obtain recognition of the disease, to secure correct diagnosis.

If we take the principal classes, in only one, namely, Europeans, is the mortality from all causes less than in 1896. The enhancement varies from 4.51 amongst Parsees to 19·76 amongst Musalmans.

Notwithstanding the high mortality of the year, the European mortality is lower than in many previous years, as will be seen from a table following. This is remarkable. The low mortality in the European population is very remarkable, for Europeans not only did not flee the City at any time, but many of them approached the disease, and exposed themselves to contagion in aid of the sick.

The mortality by *class* has fluctuated between 23·9 per 1,000 amongst Hindu low-caste, 5·4 amongst Musalman, and 1·7 per 1,000 amongst Europeans.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM PLAGUE BY CLASSES IN 1897.

CLASSES.	Population by Census of 1891.	Number of Deaths.	Death rate per 1,000 of Population.
Jains	25,225	373	14·78
Brahmins	37,982	397	10·45
Lingaets	784	26	33·16
Bhattias	7,891	59	7·47
Hindus of other castes ...	451,465	7,172	15·88
Hindus, low-caste	45,169	1,084	23·99
Musalman	155,101	846	5·45
Parsees	47,458	357	7·52
Jews	5,021	30	5·97
Native Christians	29,712	580	19·52
Eurasians	4,330	42	9·69
Europeans	11,290	20	1·77
Negro-Africans	146	4	27·39
Buddhists	190	—	—
Other and Unknown castes...	—	13	—
Total	821,764	11,003	13·39

The mortality by *habitations* indicates the influence of ventilation in giving protection against the disease, for it has generally been lowest in the highest rooms of the highest buildings.

The distribution of mortality by *districts* discloses an extraordinarily low mortality in one district—the Fort, South. In this district in 1896 the total mortality from all causes did not exceed 5·31, and in 1897 it was not more than 8·85 ; and yet round this district a cordon was not placed, nor were any measures taken that were not carried out in other districts.

The recurrence of the disease by *houses* is most interesting. In those buildings from which the downtake pipes were removed and disinfected, and, if they were imperfect, replaced, and open drains constructed in the house gullies properly connected to the sewers, the disease has not greatly revived. I take two buildings, both on Mandvi Bunder. In one building in 1896, 19 cases occurred, in the following year 7 cases, and in 1898 2 cases. I take another building on the other side of the bridge. In 1896 as many as 17 cases occurred, in 1897 only 2, and in 1898 but 1.

The mortality from Plague by sex and age indicates that the disease has been *most* fatal to *males*, and most fatal *after* adolescence had been reached. In both sexes there is a remarkable ascent in the mortality about the 10th year of age. Amongst males the most fatal period was between 35 and 40 years of age, and amongst females in the early years of puberty and later life. It may be said that under five years of age the recognition of the disease is more difficult and the malady more rapidly fatal than at advanced periods. Hence the *true* mortality in childhood is *not* known, nor the incidence of the disease at different periods of life indicated by the statistics.

The mortality was highest with the greatest intensity of the disease towards the end of January and the beginning of February. The number of cases decreased through March, April, May and June, till the minimum of 42 was reached in July. From the middle of July the mortality commenced to increase, and continued with fluctuations to increase till the end of the year, rapidly rising in December into an epidemic fatality.

The proportion of deaths to cases by dwellings is most interesting.

TABLE SHOWING THE PROPORTION OF DEATHS TO ATTACKS FROM PLAGUE IN ALL WARDS AND THE WATER DIVISION, FROM JANUARY TO DECEMBER 1897.

Wards.	Ground Floor.	First Floor.	Second Floor.	Third Floor.	Fourth Floor.	Fifth Floor.	Harbour.	Road side.	Unknown.	Total.
A	72·2	65·8	70·4	57·1	53·8	54·5	66·6	58·6	—	67·8
B	71·1	68·6	59·9	58·9	47·7	33·3	66·6	68·4	—	65·7
C	80·3	78·7	64·8	57·7	42·1	33·3	—	66·6	—	75·6
D	84·7	74·3	58·9	64·2	33·3	—	—	63·1	—	81·5
E	87·5	80·0	77·2	66·6	50·0	40·0	—	50·0	—	84·0
F	92·0	77·7	66·6	100·0	—	—	—	93·3	—	90·8
G	83·6	63·8	63·6	50·0	—	—	—	80·0	—	82·3
Unknown	—	—	—	—	—	—	—	—	100·0	100·0
Water Division ...	—	—	—	—	—	—	100·0	—	—	100·0
Total ...	84·7	75·5	67·3	59·7	48·1	45·4	84·6	62·2	100·0	82·6
Total last year	74·7	79·0	76·5	66·1	59·0	66·6	—	96·3 85·1		76·1

This mortality in dwellings illustrates the influence of ventilation on the disease.

The chances of recovery progressively increased from the *first* floor upwards ; from 84 per cent. on the ground floor to 45 per cent. on the fifth floor the mortality decreased ; and even the people picked up on the road side, destitute though they may have been, had a better chance of recovery than those living on the ground floor. The proportion of mortality to the height of residence indicates the great influence of exposure to the air in preventing the spread of the disease. It will be observed that in *all* the wards there is the same progressive decrease in the fatality with the height of buildings.

It is an interesting fact that the number of persons found on the road-sides decreased progressively from January up to December, in which month, with the development of the epidemic, the number commenced to increase.

In another portion of this report I have referred to the influence of house-drainage in preventing the recrudescence of plague. At first I thought the effect of drainage was due to the improvement of the general sanitary condition of buildings, but I have now come to the conclusion that it is dependent on the closing of rat-holes and the demolition of the homes of the rats. When plague recurs frequently, it is, I believe, due to there being favourable hiding and feeding places for the animals. If it were practicable through any public agency to carry out house-drainage, to remove and clean all down-take pipes, to construct and repair all house drains and gullies, it would have a great influence on the recrudescence of plague.

It is a remarkable fact that the highest mortality from plague occurred in the sections to the north and south of the Island. To the north the highest mortality occurred in the sections north of a line running through Grant Road, and to the south in the suburbs of Colaba. A lower mortality occurred from plague in the surface crowded portions of the City than in the suburbs. The explanation, I believe, is ventilation ; the chawls in which the poor classes live have often a gully on one side, and into this gully windows open. In consequence of this there is more air circulation in the rooms in which they live even in chawls than in the central and dark rooms in the old-shaped buildings in the suburbs, although these buildings may be in the fields or surrounded by open spaces.

The knowledge that rats are carriers of the disease is widespread, and is now being practically made use of by people who never had cats before, but who now keep and feed cats. (In the houses of people who never kept cats before, cats may now be seen, and even people who had a dislike to the animals may now be seen putting out food for them).

The experience of last year has been repeated. Cases have generally been preceded by the disease among rats.

Dr. Gimi, in a note on the mortality amongst rats preceding cases of plague, states that about the middle of January 1898, in Popatwadi, Girgaum Road, and Marine Street, dead and dying rats, were found, and that cases of plague occurred a few days afterwards. He also noticed that up to the above date the mortality in Dhobi Talao Section ranged from 3 to 5 deaths a day (including one or two deaths from plague), but within a *week* after the appearance of sick rats, the cases of plague increased from 8 to 13 a day for a week.

Dr. Godinho also submitted a note on the infection from rats, their routes of migration, and the mortality following on their appearance in houses in Dukargally, chiefly Burrow's Lane and Khoja Street, during January, February and March 1898. His observations showed that the rats travelled from south to north and from east to west, seldom or ever the contrary points, and that they infected one side of a street first, and then the other, before departure.

In the report on plague in 1896 I held that the treatment of the sick might be modified according to (*a*) the type of the disease, and (*b*) the ventilation of buildings. I believe the correctness of this view has been established by experience. I can see no reason why patients ill from plague should not be treated inside the verandahs of buildings when the verandahs are wide and look on to open spaces ; *or why in the fair weather, when there is open space outside buildings, awnings should not be put up and patients allowed to be placed under them.* There is no use in evading the fact that the patients would be better placed for themselves and of no more danger to others under these conditions than in many private hospitals.

I have contended since 1896 that every effort should be made to encourage the people to submit to inoculation with Mr. Haffkine's prophylactic serum, and that measures should be taken to make use of inoculation against plague in the same way as measures are adopted to carry out vaccination against small-pox.

There was before the end of the year serum ready for 100,000 people, and I was strongly of opinion that while all the sanitary measures, adopted from the beginning, should continue to be enforced, inoculation should be used as an additional weapon to protect the population. It is a weapon ready to hand and should be used with every other weapon at hand to resist the pest. Such was my opinion. The sole encouragement of inoculation has from the first come from the municipality—the credit of supporting it when it was discouraged is due to us.

It will be observed that the mortality in the two Municipal Hospitals was almost the same. In Grant Road Hospital the percentage of deaths to cases was 67·4, and in Arthur Road Hospital the mortality was 67·87 per cent. The average mortality to be expected amongst the Hindu population generally, under the most favourable conditions of treatment, may be taken at about these results. Amongst some classes, as Europeans, the mortality may be lower ; for instance, in the European General Hospital the mortality was 35·2.

When the mortality from all causes is examined in the large and important classes of population, living more or less together, it will be observed that it is highest amongst Hindoo low-class, as this group of communities is classified ; being as much as 103 per 1,000. In one class, namely Europeans, it is normal. After Europeans the mortality ascends through the Parsee and Brahmin communities, and reaches 42 per 1,000 amongst Eurasians and 44 per 1,000 amongst Jews. Jews are therefore in this city more susceptible to this and other diseases than Europeans. The cause is simply this—there is a large number of very poor Jews in Bombay and a large immigration of destitute Jews every year.

The mortality by *months* shows that the plague epidemic had commenced to *wane* in January. In that month 7,518 deaths were registered ; in February the mortality fell to 6,860, and continued to fall till the minimum mortality was reached in June. In July the mortality rose to 2,989, and in August it ascended still higher, for 3,924 deaths were registered. Through September, October and November the mortality decreased, till in November 2,840 deaths were registered ; but in December, when the recrudescence assumed an epidemic character, there was a great rise in the mortality, and as many as 3,615 deaths were registered in this month.

There were, therefore, *three* distinct periods of epidemic intensity during the year :—1, in January ; 2, in August ; 3, in December.

STATEMENT SHOWING THE NUMBER OF DEATHS FROM ALL CAUSES BY MONTHS IN 1896 AND 1897.

Months.	No. of Deaths from all causes exclusive of still-born, in 1896.	No. of Deaths from all causes, exclusive of still-born, in 1897.
January	2,171	7,518
February	2,253	6,860
March	2,534	5,336
April	2,565	3,528
May	2,427	2,353
June	2,029	2,208
July	2,299	2,989
August	2,669	3,924
September	2,616	3,476
October	2,868	3,249
November	2,889	2,840
December	6,131	3,615
Total	33,451	47,896

The incidence of the mortality by place of birth shows that during this year of pestilence the people born *in* Bombay suffered much *less* than strangers. While the deaths amongst people born in Bombay were only 2,554 more than in 1896, the mortality among strangers was as much as 10,997 higher than in that year. The average number of deaths among people born in Bombay is 12,607, and amongst strangers 12,924. It will therefore be seen that the mortality in this year, if classified according to place of birth, is in *excess* of the average by 3,584 deaths among persons born in Bombay, and 17,655 *deaths among strangers.* In short, the mortality amongst strangers has been more than *double.* The reason of the lower mortality amongst the population born in Bombay is, as in the case of Europeans, better dwellings.

The influence of the plague epidemic on the health of people born in Bombay is well shown in the incidence of the mortality by months. The mortality among people born in Bombay rose in January to 2,497, and fell in May and June to the normal level. The recrudescence in July and August is shown in the higher mortality amongst people born in Bombay in these months ; but after August the mortality till December did *not* rise much amongst them.

The highest mortality from any one death cause is referred to plague, being 13·3 per 1,000. The three chief death causes that contributed to the high mortality are :—1, plague ; 2, diseases of the respiratory system ; 3, fevers.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM THE PRINCIPAL CAUSES DURING 1897.

Cause of Death.	No. of Deaths.	Death-rate per 1,000 of population.
Small-pox	57	·07
Measles	359	·44
Fevers	6,951	8·46
Cholera	1,265	1·54
Phthisis	5,927	7·21
Plague	11,003	13·39
Diseases of the Nervous System	2,141	2·60
Do. do. Respiratory System	7,857	9·56
Diarrhœa	1,869	2·27
Dysentery	1,682	2·05
Accidents	520	·63
Other and unknown causes	8,265	10·06
Total	47,896	58·28

Amongst death causes that contributed to increase the mortality, it will be observed, are deaths from old age or debility; 3,206 deaths were referred to these causes, being as many as 782 above the average.

In a year when the calamity of pestilence fell on a population already tried by famine, and the thoughts of the people were to escape the dread scourge, it might have been hoped that fewer human beings would give thought to destroying one another, or to injuring themselves; and it might have been expected that fewer persons would have endangered their own lives or undertaken enterprises of risk. And it was so in one respect, for the deaths due to poisoning are 23 below the average; but the deaths due to injuries are 107 above the average.

It is a suggestive fact that, if a line is drawn along Grant Road, the highest mortality occurred to the north of this line, commencing on the east; the sections of the highest mortality being immediately to the north of the line, *i.e.*, 2nd Nagpada and Kamathipura. While the third section of the line is Tardeo, in which the mortality was 79·71. Further north still, to the immediate north of Nagpada, is Byculla, with a mortality of 80·71; and further on Parel, with the fourth highest mortality. And the sections to the south of the line are localities of very high mortality—Khara Talao with a mortality of 64 and Kumbharwada with a mortality of 58. To the south of these sections and the south of this line the mortality declines; for immediately further south is the Market, with a mortality as low as 27; and further south, the Esplanade, a section in which the mortality fell to 16. But further south still, the mortality in the Fort North rises to 34; and further south still, in Middle Colaba, to 48.

It is a most interesting fact that in some of the most crowded portions of the central portions of the city the mortality in this year of plague and of panic was comparatively low. In the sparsely populated districts in the suburbs, the mortality has been higher than in densely populated localities, such as the Market and the Fort North. This may partly be explained by the migration of the people in 1896–97 from the city to the suburbs in the north of the Island. A very great movement of population did take place to the northern suburbs, and the disease did not follow that migration as I pointed out in the Report for 1896.

It is also interesting to observe that the mortality in Chaupati for the whole year is lower than on the favourite hills of Walkeshwar and Mahalakshmi; and Chaupati extends to the bottom of these hills.

The old-fashioned building of the suburbs, though it may be in a field, has a number of dark rooms with less ventilation than the rooms in the immense chawls in the city. Even in the military lines on the Esplanade we saw done what the people are doing in the suburbs—verandahs carried out far and so low that the inner rooms were left without wholesome light and air. And so it is, although there may be open space around the old-fashioned buildings in the suburbs, there are inner rooms in darkness, into which the light from outside cannot enter, nor the air freely pass.

Small Pox.—During this year the mortality from small-pox has been very small. 57 deaths were registered, being 644 less than in 1896 and 392 less than the average. Small as the mortality from small-pox was, the incidence was distributed by sections, as in 1896, when the disease was epidemic. It fell heaviest on the most insanitary and most undrained districts. The greatest number of deaths were registered in the Nagpadas. The mortality from small-pox fell heaviest on females, as in previous years, and in the earliest periods of life.

Measles.—From measles there were 359 deaths, being 118 more than in 1896, but 155 less than the average. The distribution of the mortality by classes is the same as in 1896, the highest mortality having occurred amongst Hindu low-caste, and the next highest amongst Mussulman. The mortality by sections follows nearly the same incidence as in 1896, being highest in 2nd Nagpada, Byculla, Tardeo, Kumbharwada, Kharatalao and Kamathipura—all sections of high mortality in 1896.

Fevers.—As the mortality from plague decreased, the mortality from fevers generally declined. All through this monsoon, in July, August, and September, there was a serious increase in the mortality from fevers, concurrently with the prevalence of cholera. In July the mortality from fevers rose to 457, in August to 593, and in September to 567. Through October and November the fever mortality declined to 422 and 324, to again increase in December. The mortality from fevers generally decreased greatly in February. In January 1,836 deaths were registered from fevers, while in February the number fell to 1,006. It was conjectured that the high mortality in January from fevers was due to deaths from plague, being included in the general fever mortality. If this occurred in January, it must also have occurred in February. Against this belief is the fact that,

after the operations of the Plague Committee commenced, and when concealment of plague cases became more general, the mortality from fevers did not rise.

The decrease in February in the mortality from fevers occurred amongst all classes except Parsees ; and in this class mortality slightly rose, to be followed by a great decline in March. Again in July the number of deaths from fevers commenced to increase with the rise in the general mortality. The mortality from fevers registered amongst Parsees was exceptionally low, being 2·7. It seems to me that this clearly shows that in the Parsee community deaths from plague could not have been largely referred to fevers generally. Throughout the monsoon the mortality from fevers amongst Europeans was higher than in the epidemic period of plague.

Compared with 1896 the mortality from fevers was lower in all classes. It is a curious fact that the mortality from fevers amongst Brahmins was below the average. Among the Hindu population generally the mortality in 1897 was less than in 1896, and very nearly normal.

The number of deaths registered from fevers was 6,951, being 1,825 less than in the last year, and 95 less than the average. Of the fever deaths, 5,904 were referred to remittent fever, being 1,389 less than in the last year, but 155 more than the average ; 789 were ascribed to simple continued fever, being 378 less than in the last year and 178 less than the average ; 225 were due to ague, being 55 less than in the last year and 78 less than the average ; 33 were referred to enteric fever, being 3 less than in the last year, but 6 more than the average.

The highest mortality from fevers occurred in Parel, Sewri, Kamathipura, 2nd Nagpada, Byculla, and Tardeo. The high mortality from fevers in these districts may be ascribed to imperfect recognition of plague. Yet in suburbs, such as Parel, Sewri, and Mahim, the discovery of concealed cases was comparatively easy. I ascribe it rather to difficulty of recognition of the disease during life, and neglect of medical assistance. It will be observed that in some of the most crowded localities, as the market, where concealment of cases is very easy, the mortality from fevers was lower than in the suburbs.

Cholera.—During the rainy season a serious recrudescence of cholera occurred. 1,265 deaths were registered, being 775 more than in 1896 and 1,001 above the average. From April to August the mortality progressively increased. Arranged by months, the incidence of the mortality takes the same line as in 1896. There is a marked increase in July, rising to a maximum in the beginning of August.

The influence of the proximity of damp ground on the incident of cholera is well shown by statistics. Of 1,480 cases, as many as 879, or more than 59·39 per cent. occurred on the ground floor. The explanation, I believe, is that which I offered last year : the development of cholera germs in the muddy or damp ground around or in dwellings, and the greater exposure of people sleeping on the ground floor to them.

In all 1,480 cases of cholera were reported, 1,265 of which proved fatal.

I have already drawn attention to the fact that the mortality from cholera has been highest in the suburbs to the north and south. Byculla and the sections close to it suffered most in the north ; while Middle and Lower Colaba were most affected in the south.

As in 1896, the highest mortality occurred amongst Hindu low-caste and Native Christians. It is remarkable that the classes who suffered most are probably the classes most careless about their food and water.

The mortality by age periods follows the same incidence as in former years, being highest between 30 and 40 years of age.

Phthisis.—From phthisis 5,927 deaths were registered, being 1,118 more than in 1896 and 2,153 over the average. The mortality from phthisis follows nearly the same incidence as in former years. It has in each year pointed to the great loss of life caused through seclusion in crowded and ill-ventilated dwellings. The female mortality has been more than double the male, and this loss of life falls on Musalman and high class Hindus. Even amongst poor Hindus, notwithstanding the laborious lives the women live and the privations they have to endure, the mortality is relatively low—under 6 per 1,000. The sections of highest mortality from phthisis are the most overcrowded and ill-ventilated sections of the city. The sections of ill-repute are 2nd Nagpada, Umarkhadi, Chakla, Bhuleshwar, Khara Talao and Kamathipura ; and they have always been sections of the highest mortality, and not one of them has any open space for ventilation and recreation. The mortality from phthisis also indicates that the death registration in 1896 was not so defective as in 1897, exactly the same sections are sections of high mortality in 1897 as in 1896. It was contended in 1896 that, under the mortality from phthisis

were registered a number of deaths from plague. But judging from the statistics of 1897, it does not seem to have occurred to any large extent, nor does the error from this cause appear to have been so serious as was apprehended.

The mortality from phthisis in 1897 must be viewed with considerable suspicion, as there is little doubt that the enhancement of the phthisical mortality was due to either cases of plague being mistaken for phthisis, or to the concealment of plague, under this cause. The total mortality—5,927—is 1,118 higher than in 1896. The distribution of the mortality by sex shows that it is 1·39 higher amongst males and 1·31 higher amongst females than in that year.

From diseases of the respiratory system 7,857 deaths, being 2,523 more than in 1896 and 2,970 more than the average, were registered. Of these deaths 4,830 were referred to bronchitis, being 1,809 more than in the last year and 1,893 more than the average, and 1,332 were referred to pneumonia, being 258 less than in the last year but 41 more than the average. The mortality from diseases of the respiratory system was highest in 2nd Nagpada, Kharatalao, Kamathipura, Umarkhadi, Chukla, and Dongri. These are also the sections of highest mortality from phthisis. All these sections have great density of buildings and an overcrowded population.

APPENDIX.

No. 1.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner with the Government of India for 1897.

Unlike those of its immediate predecessor, the meteorological features of the year, for India as a whole, were not to any marked degree abnormal. Although the South-West monsoon was late in arriving, it was favourably distributed and was followed by good harvests. "The mean humidity for "the whole year for the whole country was slightly below the normal." Excepting in Assam and parts of Burma the temperature was in excess in May, and very generally excessive over India in June. Otherwise the climatic conditions of the year did not much differ from those which ordinarily prevail.

2. The European Army of India, of an average strength of 68,395 men, was less healthy than during the previous year. This diminished healthiness was due, in part, to increased prevalence of diseases of malarial origin, and in part to exposure and injuries on field service. The diseases, however, to which sickness and mortality were mainly due, were the same in both years. The chief causes of admissions into hospital were venereal diseases and ague, the former accounting for a ratio of 487·7, and the latter of a ratio of 394·7, or, together, 882·4 of the total ratio of 1,557 admissions. Although the chief causes of admissions, these two diseases were not equally prevalent during both years. The admissions from venereal diseases decreased from a ratio of 511·6 per thousand of strength in 1896, to a ratio of 487·7 in the year under report; whilst those from ague rose from a ratio of 239·0 in the former to a ratio of 394·7 in the latter year. With regard to the reduction in the ratio of admissions from venereal diseases, the Sanitary Commissioner with the Government of India says, "it appears to "have been connected with the employment of a large number of men on field service in the second "half of the year, as the number of venereal admissions was much lower from July to December "than from January to June." The great increase in the prevalence of ague is attributed to "increase of malaria consequent on the prolonged drought followed by an abundant monsoon." Besides fevers, some of the other diseases which contributed to the increased ratio of admissions were cholera and bowel complaints. Of the total sickness, venereal diseases caused 31 per cent., and ague 25 per cent. As usual, enteric fever was the most fatal of all the diseases. Of the total ratio of 22·93 deaths per thousand of strength for the year, this disease alone accounted for 9·01, or 39 per cent. The other diseases which contributed most to the mortality were dysentery, hepatic abscess, and cholera; but the combined mortality due to these three was equal to a ratio of only 4·99, or little more than half of that due to enteric fever by itself. The rise in the death-rate from all causes over that of the previous year was great. Whilst the ratio recorded for 1896 was only 14·84, and for the decennium 1886–95 only 15·16, that for the year under report was 22·93. The loss due to invaliding at the same time rose from a ratio per 1,000 of strength of 28 in the preceding year, and of 24 in the decennium 1886–95 to 33 in 1897; whilst the total loss, from death and invaliding combined, rose to a ratio of 56 per thousand of strength as compared with 43 in the previous year, and with 39 in the preceding decennium. Amongst the causes which necessitated invaliding the first place was taken by secondary syphilis. The total number invalided during the year was 2,258, and to secondary syphilis alone 611 of this number were due. The diseases which most closely followed secondary syphilis as causes of invaliding were debility, malarial fevers, and tubercle of the lungs; but the total number invalided on account of these three causes combined, amounted to only 456 as compared with 611 from secondary syphilis by itself.

3. As in the previous year, of the four Commands, the Bengal Command was the most unhealthy and the Madras Command the most healthy. The total death-rate of Madras only reached to 56 per cent. of the death-rate in Bengal. In point of mortality the Punjab Command followed Bengal very closely: in the former the death-rate per thousand of strength was 21·52 and in the latter 23·32. So, on the other hand, did the mortality in the Bombay Command closely approximate to that of Madras: in the former the death-rate was 13·10 and in the latter 14·33. But although the Madras Command shows the lowest death-rate, its constantly-sick rate was higher than that of either the Punjab or Bombay. Its admission-rate, however, was the lowest of all the Commands, a result mainly due to its comparative immunity from intermittent fever. The ratio of admissions into hospital from this disease was only 121·5 per thousand of strength in Madras as compared with 356·1 in the Bengal, 406·4 in the Bombay, and 442·5 in the Punjab Command. Intermittent fever, although largely influencing the admission-rate, had little effect on the death-rate: in neither of the Commands did this reach ·5 per thousand of strength, and it was lower in Bombay than in Madras. The diseases mainly concerned in creating the striking difference between the death-rates in the Madras and Bengal Commands were cholera and enteric fever. Whilst the former of these diseases was credited with a death-rate of 3·28 in Bengal, the rate was only 0·32 in Madras; and whilst enteric fever had attributed to it a death-rate of 10·39 in Bengal, the rate was only 4·93 in Madras. In the Punjab the mortality from enteric fever was still greater than in Bengal, and was the chief cause of the high

death-rate in that Command, accounting as it did for 11·05 of the total death-rate from all causes of 21·52. But for the somewhat greater fatality from enteric fever in the Bombay than in the Madras Command, the death-rates in these two Commands would have been almost the same. Of loss from invaliding, on the other hand, Madras gives by far the highest ratio per thousand of strength; whilst the Punjab gives the lowest. In the latter this ratio was only 21·9 as compared with 31·8 in Bombay, 40·9 in Bengal, and 47·5 in Madras. As already stated, to no disease was invaliding so largely due as to secondary syphilis; and the Madras Command had, "as usual," the highest ratio of cases of secondary syphilis.

4. Comparing the ratios of sickness and mortality of the troops according to Geographical Groups, it is seen that the constantly-sick rate was lowest in the Western Coast, and highest in the Rajputana, Central India, and Gujrat Group. In the former group the rate was 76·9 per thousand of strength as compared with 127·7 in the latter. In respect of mortality from enteric fever, more especially, these two Geographical Groups differ widely. The ratio of mortality from enteric fever per thousand of strength in the Western Coast Group was only 3·40; whilst in the Rajputana, Central India, and Gujrat Group it was 20·16. In the previous year, however, the positions of these two groups with respect of enteric fever mortality were reversed; the ratio in the former having been 10·28 as compared with 8·39 in the latter. The strength of the garrison of the Western Coast Group was only 1,471, and ratios calculated on numbers so small are liable to fluctuate from year to year between somewhat wide limits. "The percentage of enteric fever to total admissions in 1897 was greatest in the hills."

5. Of the larger stations with garrisons exceeding in strength 1,000 men, Agra, Peshawar, Meerut, Mhow, and Umballa, show the highest death-ratios. "All these stations had increased mortality from enteric fever." Yet two of them, Agra and Meerut, are supplied with filtered pipe-water from the municipal waterworks. Regarding Meerut it is stated in Table V. that "the water-supply is good and abundant, and there is no source from which it is liable to be contaminated." In the same table it is stated, with regard to the prevalence of enteric fever at Agra, that the disease "was almost certainly due to contamination of the municipal water-supply." Again, in the case of Peshawar we find the remark "there is no defect in the water-supply, which comes into the station direct from the Bara River in pipes through filtering beds." Of Umballa, it is said:—"The disease in the first "instance was due to exposure on military service in an unhealthy climate; in the second to "drinking of contaminated water by men recently arrived in the country. The prevalence of the "disease was due to the drinking of contaminated water from a disused well." Thus, in two of these four stations, the water-supply is described as having been free from objection, and yet one shows a death-rate from enteric fever of 18·58 and the other of 26·93: in the other two the water was condemned as being contaminated, and the enteric fever death-rate was in the one 15·32 and in the other 45·04.

6. *Principal Diseases.*—There was a marked decrease in the prevalence of *influenza:* the ratio of admissions into hospital fell from 11·5 per thousand of strength to only 4·0. Not only was the disease less prevalent, but it was apparently also of a milder type. Whilst the average number of men constantly sick with influenza was 10, against 61 in 1896, the average duration of a case was only 13 against 28 days.

7. *Cholera* was more fatal than during the preceding year and accounted for 80 deaths, as compared with 63 in 1896. In the single station of Sitapur no fewer than 41 of the 80 deaths took place. There was in this station a garrison of only 435 men when the disease broke out, and of this small number 65 were attacked by cholera and 41 died. As exemplifying the influence of anti-cholera inoculation in conferring immunity in the case of a small number of men who had submitted themselves to be operated upon, we read at page 149 of the Report:—"Among the 27 inoculated men "four were attacked and two died. So that, among the uninoculated the percentage attacked was "14·9 and the case mortality about 63 per cent., while among the inoculated the percentage attacked "was 14·8 and the case mortality 50 per cent." From the results obtained in the case of numbers so small, it would be unsafe to generalise; but so far as they go they cannot be said to lend much support to the belief of those who maintain that in anti-cholera inoculation, as at present practised at all events, they have discovered an effectual means of cholera prevention. In our *memoranda* on the Provincial Sanitary Reports we have dealt with the question of the influence which the disinfection of water-supplies seemed to exercise in the prevention of cholera. The results so far, although by no means conclusive, seem to support the belief that disinfection is, on the whole, beneficial. As the Sanitary Commissioner with the Government of India concisely puts it:—"The experience of the "year teaches little that is new in the prevention and treatment of epidemic outbreaks of cholera in "India. The old lessons are repeated; cholera cannot be prevented by any single precaution, and no "possible precaution should be omitted; when the disease appears in epidemic form, prompt "movement, intelligently carried out, is the most effective check."

8. Of *small-pox* there were 24 cases with 4 deaths, as compared with 122 cases and 10 deaths during the previous year. The admission-rates and the death-rates were both below the decennial ratios of 1886–95.

9. *Intermittent, remittent,* and *continued fevers* were all greatly more prevalent than in 1896. In the present, as in the previous Report, the Sanitary Commissioner shows that some of the medical officers differ as to where they draw the line between simple continued fever and enteric fever, as well as between the former and ague. Likewise, with the decrease of ague and influenza recorded in Burma Coast, a great rise is noticed in the number of cases of simple continued fever. In explanation of this the Medical Officer at Rangoon notes that what is called by one medical officer "influenza" may by another be designated "simple continued fever."

10. Regarding the prevalence of *enteric fever* in 1896, we noted that it continued its destructive course without substantial abatement. The ratio of deaths caused by it in that year was 6·31 per thousand of strength of the European Army of India: in the year under report this ratio has risen to

9·01. During the previous year the enteric fever deaths numbered 445 : during 1897 they numbered 556. There has thus been not only no diminution but a large increase in the mortality caused by the disease. As might have been expected, the question of the growing prevalence and fatality of enteric fever is very fully dealt with in the Report. The opinion so long maintained by many that enteric fever is solely a water-borne disease, is in process of giving way before an accumulation of evidence tending to show that the enteric bacillus is much more widely diffused than has generally been supposed. Indeed, so various and numerous do the sources of infection appear to be, that if prevention is to be attempted with any reasonable prospect of success, attention cannot be exclusively concentrated upon securing purity of the soldier's water-supply, but must be bestowed on every detail of his environment. Hitherto, when a case of enteric fever has appeared, it has too often been the custom to jump at once to the conclusion that the water-supply alone was at fault, and to proceed to support this assumption by an investigation exclusively devoted to the water-supply. If the enteric fever bacillus has not been discovered in the water, it has been considered sufficient to repeat the customary condemnation of the supply by declaring it to be, at all events, "liable to contamination," a description which might very often be applied to water-supplies. The question of the causation and spread of enteric fever in the European Army of India, is dealt with in the Report in the light of our most recent knowledge and in a spirit of open-mindedness and impartiality not too common.

11. The admission-rate from *venereal disease* showed some decrease, but was still very high. From a ratio of 522·3 per 1,000 of strength in 1895, the rate decreased in 1896 to 511·6, and now in 1897 to 485·7. The table given at page 59 of the Report shows the admission rate for venereal disease year by year since 1872, the first year for which the records for India as a whole are available. From this table it is seen that the ratio of admissions from primary syphilis was 61·2 in 1872, and that it had only increased to 90·2 up to 1884. From that year, however, the increase was rapid, and the enormous ratio of 201·7 was reached in 1895. It will be seen from the table that secondary syphilis was almost stationary between 1872 and 1884 : in the former year it gave a ratio of admissions per thousand of strength of 22·4, and in the latter of 24·4. From 1884, however, its increase has been great, until the year under report, when a ratio of 101·9, the highest recorded, has been reached. This growing prevalence of secondary syphilis is a most unfavourable feature of the history of venereal disease in the European Army of India. There were 23 deaths and 662 invalidings *directly* due to venereal disease, against 14 of the former and 479 of the latter in the preceding year. From this it is evident that the slight decrease in the admission-rate, cannot be taken as an indication of any corresponding abatement in the destructive effects of the disease during the year under report. The number of men constantly sick in hospital from venereal disease in 1897 was 2,991·59, equivalent to about three regiments. Such figures may be left to tell their own tale. Those who are not convinced by them of the alarming ravages of venereal disease amongst our young soldiers, and of the urgent need for the adoption of all practical measures for holding it in check, would not be convinced by any description of the physical ruin it inflicts on its victims and on their posterity. A visit to the wards of the Netley Hospital might help to dispel the doubts of those who still continue to regard with scepticism the official figures showing the havoc annually wrought by venereal disease amongst the soldiers of the European Army of India.

12. Sickness and mortality were greater in the *Native Army* than during the preceding year, but were much less than in the European army. Whilst in the latter the ratio of admissions into hospital was 1,557 per thousand of strength, in the Native Army it was only 839, or not greatly over half. The constantly-sick rate was, at the same time, more than three times greater in the European Army, and the death-rate 22·93 as compared with 14·90. Although the ratios of sickness and mortality in the Native Army were considerably higher in the year under report than in 1896, they were below those of the ten-year period 1886–95. The chief causes of admission were ague and dysentery, ague alone causing 41 per cent. of the total admissions. The Sanitary Commissioner with the Government of India writes :—"Owing to the arrival of an abundant monsoon after a "prolonged period of drought, there was an increase of malaria, and therefore of fever and mortality "in 1897 as compared with 1896. The sickness and mortality were also raised by the employment "of a large body of men on active service." The contrast between the comparative immunity of the Native Army from diseases which are the scourge of the European Army is as striking as usual. Whilst in the Native Army the death-rate from enteric fever was only 0·12 per thousand of strength, it was 9·01 in the European Army. Likewise, whilst amongst the native troops the rate of admissions into hospital from venereal diseases was only 40·8 per thousand of strength, it was in the European Army 485·7 On the other hand, pneumonia was accountable for a death-rate of 2·73 in the Native Army and of only 0·60 in the European Army, and remittent fever of 1·04 in the former as compared with ·60 in the latter. Cholera, dysentery and hepatic abscess were greatly more fatal in the European than in the Native Army, the ratios for these three diseases having been, consecutively, in the former 1·17, 2·53, and 1·29, as compared with ·52, ·67, and ·06 in the latter.

13. Whilst the European Army had only five admissions and no deaths during the year from *plague*, the Native Army had 131 admissions and 82 deaths. The disease was confined to the Bombay and Madras troops. As with cholera, so with plague, evacuation of the infected quarters occupied by the troops has been found to be the most effectual measure yet discovered for cutting short an outbreak of the disease. At the conclusion of a full account of the plague, covering upwards of 40 pages, the Sanitary Commissioner says :—"One of the great lessons to be learned "from Indian experience is, that simple isolation of the sick and of those who have been in contact "with them is of no ultimate use. Nothing short of total evacuation is certainly effectual, total "evacuation involving life in fresh open air at a considerable distance from the infected locality." Increased experience and knowledge of the modes by which plague may be propagated, have tended to bring about a modification of the measures on which reliance was placed in the earlier days of the epidemic to check the progress of the disease. The part which rats and other animals play in the propagation of plague has not yet been fully worked out ; but if this part is at all of the importance which Hankin and other scientific observers seem to attach to it, the position taken up by those who would rely on land quarantine to prevent the spread of plague becomes much weakened and

scarcely tenable. Much knowledge has been accumulated since the first appearance of the disease in Bombay in September 1896; but, as Hankin puts it, "caution and reserve are still needed, and, "still more, further research," before some of the most important questions connected with the mode of development and propagation of plague can be regarded as finally settled.

14. *Jails.*—During a year in which famine and scarcity prevailed in many of the provinces, it was only to be expected that the health of the prisoners, like that of the general population from which they are drawn, should suffer. There was a considerable increase in the average strength of the jail population, which rose from 110,186 in the preceding year to 118,107 in the year under report, an increase due in part, if not altogether, to the pressure of want driving the starving to the commission of breaches of the law in order to try and preserve their own or their dependents' lives. The admissions into hospital increased from a ratio per thousand of strength in the previous year of 983, to a ratio of 1,045; and, although the constantly-sick rate of 41 was the same in both years, the death-rate rose from 27·68 in 1896 to 38·75 in 1897. The death-rate from cholera was more than twice as high as in the previous year, and the death-rate from dysentery and diarrhœa almost twice as high. The death-rate from dysentery increased from 5·91 to 11·07, and of diarrhœa from 1·98 to 3·17. The excessive prevalence of these two so-called "famine diseases" may be taken as some measure of the sufferings from insufficient and unsuitable food of the population from which the prisoners are drawn. The overcrowding to which the increase in the jail population gave rise in many provinces, might have been expected to increase the mortality from respiratory diseases and phthisis pulmonalis; but such was not the case: there was even a slight decrease in the mortality from both of these causes. The pressure on the available accommodation was great, and a reference to the "Abstract of the Sanitary Sheets of the most Unhealthy Jails" shows that out of 82 jails so described, overcrowding existed at some period of the year in no fewer than 64. "Plague "accounted for 37 cases with 20 deaths, all in jails of the Bombay Administration."

15. The remaining sections of the Report, dealing as they do with vital statistics, chief diseases of the general population, vaccination, and sanitary works, do not call for remark here: these subjects have been noticed in the several *memoranda* on the Provincial Sanitary Reports. And here we venture to make a remark on the increasing bulk of the Annual Report of the Sanitary Commissioner with the Government of India. The Report for 1894 had attained an enormous size; but relief was found by the substitution of the present concise tabular statements for those previously in use. Chiefly as a result of the recasting of those statistical tables, the report was reduced from a total of 528 pages to 374 in 1895. This welcome reduction in bulk proved, unfortunately, to be only temporary. In the following year the Report again increased to 422 pages; and now in 1897 to 492, or to nearly the number contained in the ponderous volume prior to the recasting of the tabular statement. No doubt, a considerable portion of this increase has been due to the necessity for dealing adequately with the history of an additional and formidable disease, the Plague. But although the rapid increase in the size of the report may be justified, we trust that it may be found possible in succeeding years, if not again to reduce it, at all events to check its further growth. No one who has read it will deny that the present Report is one of marked excellence; but the number of its readers will, we fear, be limited by its size.

16. *Summary.*—There was a great falling off in the healthiness of the European Army of India during the year under report, as compared with the preceding year. The ratios of admissions into hospital, of deaths, and of invalidings all showed an increase. Greater prevalence of malaria, due to climatic conditions, and exposure on service in the field, were concerned in bringing about this increase of sickness and mortality. The rise in the death-rate was largely owing to greater fatality from enteric fever, cholera, and dysentery. The first of these three diseases caused no fewer than 556 deaths of a total from all causes of 1,214. Cholera caused 80 and dysentery 82 deaths. Of the four Commands, Madras had the lowest death-rate: this only reached 56 per cent. of the death-rate in the Bengal Command, in which it was the highest. The rate of admissions from venereal diseases decreased from 511·6 per thousand of strength to 485·7, a result which appears to have been connected with the employment of a large number of men on field service in the second half of the year. On the other hand, there was a deplorable increase in the amount of secondary syphilis. To this disease alone no fewer than 662 invalidings were directly due. Little of importance has been added to the knowledge already accumulated regarding cholera, against which 80 deaths are recorded. The opinion so long maintained by many that enteric fever is exclusively a water-borne disease, seems to be giving way before the results of further observation and research. Evidence is being collected which shows that the cause of the disease is more widely diffused than has generally been suspected. Meanwhile, its ravages show no tendency to decrease, in spite of the unremitting attention devoted to the soldier and his environment. As in the case of the European Army, so in that of the Native Army, the year was less healthy than its predecessor. The ratio of admissions into hospital in the Native Army did not, however, very greatly exceed half the ratio in the European Army, and the death-rate was 14·90 as compared with 22·93 in the latter. There was, as in former years, the same comparative immunity of the native troops from enteric fever and venereal disease, and the same greater fatality from pneumonia and remittent fever. The Native troops suffered less from cholera, dysentery, and hepatic abscess than the European troops. Plague mortality was confined to the troops of the Madras and Bombay Commands. According to the returns, five men of the European Army were attacked but none died. The jail population in 1897, owing to the prevalence of scarcity and famine, was greater than in the preceding year, and this increase led to some overcrowding in many of the jails. The death-rate amongst the prisoners was higher than in 1896, cholera and bowel complaints having been greatly more fatal. Since its reduction in size in 1895, the Annual Report has again been rapidly growing in bulk, and it is suggested that, if it cannot again be reduced in size, an effort should be made to check its further increase.

14th August, 1899.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1897.

The year was in some important respects in marked contrast with its predecessor. Besides being deficient in quantity and irregularly distributed, the rains of 1896 ceased prematurely, leaving the winter rice crop over large areas to wither. During the year under report the rainfall was generally in excess of the mean, seasonable, and followed by abundant harvests. The scarcity and famine of the concluding months of the previous year continued throughout the first nine months of 1897. But for the privations to which the population of the tracts affected by scarcity or famine were subjected, and the general prevalence of high prices, the year would undoubtedly have been one of low mortality. Notwithstanding the prevalence of scarcity and famine, the death-rate for the Province was considerably less than in the previous year. The Sanitary Commissioner is no doubt correct in attributing this result chiefly to the abnormal dryness of the preceding year. "It is " remarkable that the mean temperature of nearly every district during every month of the year was " higher than the normal mean." Dr. Dyson thinks that the dryness of the previous year might account for the high temperatures of the first months of 1897, but is unable to say why these should have continued throughout the rains and cold season. The year was thus characterised by an abundant and seasonable rainfall, by abnormally high temperature, by famine affecting fifteen districts, and by high prices over the Province generally.

2. *Vital Statistics.*—The *birth-rate* of the year was, of course, largely influenced by the conditions affecting the public health during the preceding year. In the fifteen districts which were affected by famine during that year, the birth-rate underwent a decrease. For the Province as a whole, the birth-rate was 36·94 per thousand of population as compared with 38·03 in 1896. Patna, the division of the Province in which the famine was most severe, shows the lowest birth-rate. In this division, with its population of nearly sixteen millions, the birth-rate was only 33·93. In Chota Nagpur, the other division severely affected by famine, the birth-rate fell from 40·25 in 1896 to 34·82 in the year under report. The Sanitary Commissioner shows that scarcity and famine acted in reducing the birth-rate in two ways: by lowering the vitality of the people and so lessening their fecundity, and by compelling a large number of the males to leave their homes in quest of employment elsewhere. Although improvement in the registration of vital statistics has within the last few years made, and is still making, remarkable progress in Bengal, a comparison of the recorded with the estimated birth-rate of about 50 per thousand of population for the Province shows that a considerable proportion of the births probably still remains unregistered. Unless to difference in the efficiency with which registration is carried out, it is difficult to suggest other sufficient causes to which the great differences between the death-rates of many of the districts can be due. Excluding Calcutta, in which the conditions are exceptional, the birth-rate ranges between 47·40 in the Malda district and 28·97 in the Pubna district. In towns the variations are still greater, ranging between 52·62 and 2·11. No doubt some of the other causes mentioned by Dr. Dyson may contribute to the production of these variations; but in the score of towns returning a birth-rate of less than 20 *per mille* of their population, defective registration is probably the main if not the only cause.

3. The *death-rate*, chiefly owing to less mortality from cholera and fever, fell from a ratio of 34·17 per thousand of population in the preceding year to 32·94 in the year under report. This ratio is still 5·27 above that of the previous decade; but this result is no doubt rightly attributed by Dr. Dyson " to imperfect registration during the earlier years of that decade." As with the birth so with the death-rate, the ratio per thousand of population varied within wide limits in the rural areas of districts, and still more in towns. Whilst Chittagong records a death-rate of 49·92 in its rural areas the 24-Parganas district records only 23·62; and whilst amongst towns Lohardaga records 89·59 Maniktala records only 14·20. The enormous ratio of 152·94 in Chakaria, a rural circle in the Chittagong district, is " due to the large number of people, 5,377, who perished in the cyclone of 24th October." Of the four great natural divisions of the Province, Bihar shows a diminished mortality from all the chief diseases. Its cholera death-rate was only 1·48 per thousand of population as compared with 3·41 in the previous year, and was by far the lowest recorded in any of the divisions. From this it would appear that there is no necessary connection between famine and cholera prevalence. Its death-rates from fever, dysentery, and diarrhœa were also less than in 1896. In Chota Nagpur, the other division which suffered most severely from famine, entirely opposite results were recorded. The mortality from each of the chief diseases shows in this division an increase. Cholera was nearly six time more fatal than in the previous year, small-pox nearly three times, dysentery and diarrhœa more than twice as fatal; whilst the fever death-rate rose from 22·34 to 24·77 and was the highest recorded in any of the divisions. Regarding the abnormal mortality from cholera in Chota Nagpur, the Sanitary Commissioner considers that it " was due to four out of the five districts comprising the " division having suffered more or less severely from famine, which weakened the general vitality of " the people by a long course of insufficient and unsuitable food and thus predisposed them to cholera " and bowel complaints." But the people of Bihar also suffered from severe famine, and yet the mortality amongst them from both cholera and bowel complaints was lower than amongst the people of any of the other divisions, lower than in the preceding year, and lower than the average of the preceding ten years. It is certain, however, that the inhabitants of the jungle-covered tracts of Chota Nagpur suffered more than did those of Bihar from the use of unsuitable articles of diet, numbers of them having been driven to subsist mainly on jungle roots and fruits when their crops failed and the high price of grain placed it beyond their means of purchase. Whatever influence

such an unsuitable dietary may have had in rendering them liable to cholera, it is certain that the prevalence and fatality of bowel complaints were largely increased by it.

4. *Chief Diseases.*—Cholera, although considerably less fatal than in the previous year, was yet present in every district of the Province and accounted for 196,247 deaths. The two districts in which the disease proved most fatal were Puri and Chittagong. In the former, which always suffers badly, periodical outbreaks of the disease are shown to have been coincident with the crowds of pilgrims attending the different religious festivals; and in Chittagong, in which there were two severe outbreaks during the year, the Civil Surgeon attributes the first to the dirty condition of the tanks consequent on the prolonged drought, and the other, partly to the effects of the destructive cyclone which drifted leaves and other *débris* into the tanks, thereby polluting the water, and partly to the use of excessive quantities of bad-smelling fish at the time when food became temporarily dear within the area visited by the cyclone. In some districts, the outbreaks are attributed by the Civil Surgeons to deficient and polluted water-supply following the scanty rainfall of the previous year, and to the deterioration of tanks, wells, and streams caused by the upheaval of their beds by the earthquake of the 12th of June. The disinfection of wells with lime or permanganate of potash was tried in fifteen districts; but from five of these no definite results were reported. In the other ~~ten~~ districts, disinfection is said to have been attended with beneficial results. A tabular statement is given showing the effect on the mortality from cholera which followed the disinfection of wells in the town of Ranchi. The table gives the number of deaths from the disease during the fortnight preceding the disinfection, and the number during the fortnight following the disinfection of the wells. The comparison of the cholera mortality in the two fortnights is very striking; in fact, so striking as to suggest that disinfection by these chemicals might not have been the sole cause to which the decrease was due. Adding up columns 6 and 7, it will be seen that, whilst there were 42 cases and 18 deaths in the fortnight preceding disinfection there were only four cases and three deaths after disinfection. No one will hesitate to credit the purification of the water-supply with a beneficial effect in arresting the progress of cholera; but it is open to question if, supposing the disease had been allowed to pursue its course, and disinfection had not been tried, the mortality during the second fortnight would have been as high as that of the first fortnight with which it is compared. The violence of the outbreak may have to some extent spent itself in the former fortnight. Besides, as seems to be the opinion of the Sanitary Commissioner of the Central Provinces, it is probable that the ordinary measures invariably taken for cleansing wells, and for protecting them against pollution so soon as an outbreak of cholera declares itself, may have been important factors in checking the disease. So far as they have gone, these experiments have undoubtedly given promising results; but their numbers will have to be greatly multiplied, and they will have to be carried out systematically and with scientific precautions against error before the real value of chemical disinfectants, and their mode of action in destroying the cause of cholera present in water, can be definitely determined. The record of results of anti-cholera inoculations is still incomplete. By far the greater number of inoculations were performed on emigrant coolies bound for the tea gardens in Assam. Out of a total of 10,950 inoculated, no fewer that 7,620 were of this class; and seeing that the loss of life from cholera annually occurring amongst these coolies whilst in transit from the recruiting depôts in Bengal to their destination in Assam has hitherto been lamentable, the cessation of this loss, should it now result, would go some way to establish the claim of inoculation to confer immunity from the disease. "A complete and accurate record of the results "is expected within a short time" from the Assam Government, which is deeply interested in any measure offering reasonable promise of success in checking cholera mortality amongst the immigrant tea-garden coolies.

5. *Small-pox* was considerably more fatal than during the previous year, accounting for 19,655 deaths, as compared with 13,388 in 1896. Of the 46 districts of the Province, six contributed no fewer than 12,970 of the total number of small-pox deaths. In two of the six districts in which the disease prevailed in epidemic form, the Civil Surgeons attribute the outbreaks to the introduction of infection from other districts. Puri, it is stated, was infected from Ganjam, a neighbouring district of the Madras Presidency. In our Memorandum on the Madras Sanitary Report for 1895, the following quotation from that report occurs: "With the prospect of special increase of small-pox "following introduction from other Presidencies it remains to be seen during 1896 how far Madras "has been capable of resisting the invasion." If the Civil Surgeons of Puri and Shahabad, as well as the sanitary authorities in Madras, would make inquiry as to the degree of protection conferred by vaccination on the population within their respective spheres of influence, they would probably find reasons to satisfy them that it is unnecessary to travel beyond their own borders in search of the cause of small-pox outbreaks. In the Puri district, out of a total number of 27,924 children under one year of age available for vaccination, only 1,927 were successfully vaccinated, according to Statement No. I. of the Vaccination Report for 1897–98. In the Shahabad district the number of the same age available was 62,296; and of these only 4,505 were successfully vaccinated. Similar data are not so easily obtainable from the Madras reports regarding Ganjam; but it is gathered that there were 29,634 births in that district in 1897, and 8,853 deaths of children under one year of age, leaving available for vaccination 20,781; of this last number, 4,060 were successfully vaccinated. The number successfully vaccinated was, however, in a population of 1,836,519; whilst the number of births and the number of deaths of children under one year of age were in a population of 1,240,584. The Ganjam "district," consisting of three Circles according to the Vaccination Report, has a population of rather more than a third greater than the "district" of Ganjam according to Statement No. II. of the Sanitary Report. But even without reducing the number of successful vaccinations to meet this difference, it is seen that only one in every five of the children available for vaccination is protected against small-pox. With so great an amount of susceptible material in each of the districts mentioned, and with the infection of small-pox perhaps rarely, or never, absent from some parts of them, the causes of small-pox outbreaks are not far to seek. In the Province, as a whole, there was an increase of 25,881 vaccinations as compared with the number in 1896. As the the Sanitary Commissioner remarks:—"This is satisfactory, considering that the Province was just "recovering from the effects of a severe famine in some places, and prolonged scarcity in others."

The returns show a slight increase in the number of infants vaccinated ; but the proportion of these to the number available for vaccination is still very small, and amounts only to 208·18 out of every 1,000. With these figures as guides, there need be no delusions as to the causes to which small-pox epidemics are due. There was a considerable increase in the percentage of success in cases of re-vaccination. This percentage was 64·36 as compared with 52·59 in the preceding year, and, as Dr. Dyson remarks, "seems rather high." He adds, in explanation, that this high ratio of success "appears to be due to a considerable extent to the large number of vaccinations among adults who "have been vaccinated in their childhood, and in whose case the prophylactic power of the vaccine "virus had completely gone." The returns given on pages 15—19 of the Vaccination Report show that the all-important duty of inspecting the work of the vaccinators is carried out systematically and apparently with thoroughness.

6. *Fever* was credited with fewer deaths than in the preceding year. To the exceptional healthiness of the earlier months, owing no doubt to the early cessation of the rains in 1896, and the dryness and consequent decrease of malarial diseases which followed, was chiefly due this reduction of fever mortality. Coincident with decreased fever mortality, the sales of quinine at post offices fell off from 31,867 packets in the previous year to 27,915 in the year under report. This falling-off was probably not altogether due to decreased fever prevalence, but may have been, in part, due to the prevailing hard times and want of spare money for the purchase of medicines. The Lieutenant-Governor thinks that, "with the return of prosperity, a renewal of the demand for quinine may be "expected."

7. *Dysentery and Diarrhœa* were considerably more fatal than in the preceding year, and it is the opinion of many Civil Surgeons that the number of deaths recorded as due to these diseases was much below the actual number. The Civil Surgeon of Hazaribagh says : "No doubt a very large "proportion of the over 40,000 deaths returned as from fever more accurately should be returned "under this head, though fever whether symptomatic or really malarial probably was a sufficiently "prominent symptom to excite attention." The increase in the mortality from these diseases during the year was "almost solely due to the fact that, on account of the prevailing scarcity the poorer "classes of the people were obliged to live on herbs, roots, leaves of trees, and other unsuitable and "unwholesome food."

8. *Sanitary Works.*—"The total amount from all sources spent on sanitary works in urban and "rural areas during the year under report was Rs. 20,99,335 as against 17,61,776 in the previous year." This gives some measure of the progress being made. The amount seems small when compared with the vastness of the country, and its population of over 70 millions. One promising feature in the sanitary history of the year is the growing appreciation of sanitary improvement as exemplified by the sacrifices made in its behalf by private individuals. "The Lieutenant-Governor has observed "with pleasure that the value of works of sanitary improvement carried out by private individuals "shows a marked advance from Rs. 4,94,131 in 1896 to Rs. 11,67,469 in 1897." In Form XI., which appears for the first time in the Sanitary Report, an endeavour is made by the Sanitary Commissioner to give a concise description of the chief sanitary defects in the 147 municipalities of Bengal. The information given has evidently been collected with much care and labour. What strikes one most in its examination is the want of proportion between the death-rates of the different towns and the gravity of the sanitary defects recorded against them. Sanitation, for example, is very defective in the towns of Balasore, Arrah, Bankurah, and Kissenganj, yet their death-rates are, in the foregoing sequence, only 28·44, 28·14, 20·22, and 16·89 per 1,000 of their populations. On the other hand, sanitation does not seem to be worse in Gya, Serampore, Hazaribagh, and Lohardaga ; and yet there death-rates were respectively 54·27, 57·04, 78·51, and 89·59. It would seem from such comparisons that there must have been more potent influences affecting the death-rates than local insanitary conditions. In the case of the first group of towns named, one of these influences was most probably the neglect of registration of vital statistics. In the second group, famine drove numbers of half-starved wanderers into three at least of the four towns, and the high death-rates shown against them were, no doubt, largely due to the excessive mortality amongst these destitutes. The comparison is of use as showing that it would be unsafe to judge of the sanitary condition of towns from a consideration only of their death-rates. Regarding the precautions against plague, we read that the expenditure incurred on this account amounted to just over two lakhs of rupees. At inspection stations and observation camps for the examination of passengers coming by rail from infected areas "the total number of passengers examined was 1,181,792, of whom 17,994 were detained for "observation. Of these seven died, but in no case was plague the cause of death." This is a statement which it would be premature to deal with at present, whilst the whole question of the best means of arresting the progress of plague is engaging the attention of the Government.

9. Briefly, the season was, on the whole, healthy. In spite of widespread scarcity and famine the death-rate was lower than during the previous year. The early cessation of the rains in 1896 was followed by a prolonged period of drought, which doubtless reduced mortality from diseases of malarial origin during the first months of the following year. Registration has continued to improve rapidly since 1892. The recorded birth-rate shows a considerable decrease, and this decrease is mainly confined to the 15 districts in which famine was declared to exist during the preceding year. The lessened mortality of 1897 was chiefly due to decrease of fever and cholera. Dysentery and diarrhœa were more fatal than in the preceding year, especially in the Chota Nagpur division, in which scarcity and high prices drove many to subsist on jungle fruits and roots. Cholera, although it was less fatal than in 1896, appeared in every district of the Province and caused nearly two hundred thousand deaths. The disinfection of wells by chemicals seemed in some cases to produce a decided effect in checking the disease ; whilst in other cases it seems to have been followed by no definite beneficial results. Anti-cholera inoculation was largely practised on coolie emigrants to Assam, and an exact record of the effect is expected from the Assam Government. Fevers, as usual, caused by far the greater number of the deaths during the year. Drainage only will probably ever produce a large decrease in the prevalence of malarial fevers, and drainage on a scale sufficiently extensive to produce a sensible effect on fever prevalence in Bengal would have to be carried out at

vast expense. Small-pox was not specially fatal, yet accounted for nearly twenty thousand deaths. Vaccination makes progress, but still fails to reach more than about a fifth of the children under one year of age available for vaccination. A favourable feature in the sanitary progress of the year is the contribution of considerable sums of money by private persons for expenditure on sanitary improvement. It may be taken as some indication that the people of the country are coming to appreciate sanitation when they are willing to pay for its promotion.

9th June 1899.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-Western Provinces and Oudh for 1897.

The conditions of drought, high prices and famine, which characterized the latter part of the previous year, continued until the setting-in of the rains in June. The number of people in receipt of relief from the State rapidly increased from half a million in the beginning of January until it attained its maximum by the end of February, and was still over a million and a half in the first week of June. From the table given at the top of page 42 of the Report it appears that there were considerable showers of rain in the Provinces during January, but that until June the total fall did not amount in most parts of the country to two inches. The monsoon began in the third week of June and, on the whole, continued favourable until it finally ceased in the last week of September, With the setting-in of the rains the enormous numbers on the relief works rapidly melted away to till the fields, and by the end of September the famine was practically over. The temperatures of the year do not appear to have been very unusual. In the first two months the mean was above normal. and in the next two slightly below it. May was hotter and drier than usual, and before the monsoon burst the heat in June was intense. The temperature for the remainder of the year appears to have varied little from normal. High prices of food grains prevailed everywhere. To add to the anxieties of the year the Province was threatened with an epidemic of plague; but although the disease obtained a footing in a corner of a district, the vigorous measures taken to confine it to the locality in which it first appeared proved successful. In such a year, immediately succeeding a season of crop failure and high prices, the public health could not but suffer. There was a decrease in the number of births and an increase in the number of deaths. Taking into account the extent of country affected by severe and prolonged famine, the recorded death-rate cannot be regarded as high. Throughout the Report the census figures of 1891 are used as the basis on which ratios are calculated. The Sanitary Commissioner gives also the population numbers determined by adding the excess of births over deaths since the taking of last census. As thus calculated, it is seen that the "natural increase" of the population since 1891 has been somewhat over one million. This may be contrasted with the increase which took place between 1881 and 1887 of the preceding inter-census period. The natural increase during the latter period was slightly over two millions. From this it would appear that, since last census was taken, the rate of increase of the population has been reduced to half the rate prevailing during the corresponding years of the preceding inter-census period. In a season such as that under report when, instead of the births being in excess of the deaths, there is on the contrary an excess of 438,645 deaths over births, the regularity of the increments to the population, which can be counted on with some approach to certainty in temperate climates, is violently interrupted in a country like India. A similar but more marked interruption took place in 1894, when, owing chiefly to cholera and fever, the mortality considerably exceeded that recorded for the year under report. Pestilence in one of these two years and famine in the other have mainly been concerned in retarding the increase of the population as compared with its increase in the period 1881–87. But although increase in the number of deaths was mainly responsible in bringing about this retardation, it was assisted by decrease in the number of births. In the year under report the number of children born was the smallest hitherto recorded, at all events the smallest recorded in the table given on page 2, which includes the period beginning with 1881 and ending with 1897. On the other hand, the number of births in 1894 was, with one exception, the highest recorded since last census. The birth-rate of a year being mostly governed by the conditions prevailing during the previous year; and the previous year, 1893, having been one of the healthiest on record, the birth-rate of 1894, although itself an exceptionally unhealthy year, was a high one. The influence of the unhealthiness of 1894 is to be looked for, not in its own record of births but in the record of the year succeeding it. In 1895 the birth-rate fell from 39·70 in the preceding year to 34·90 per thousand of population. The diminished birth-rate of the year under report combined with its high death-rate to retard the natural increase of the population to the extent of not very far short of half a million. Whilst the birth-rate fell from 35·40 in the previous year to 31·10, the death-rate at the same time rose from 33·32 to 40·46 per thousand of population. These rates for the Province as a whole give, however, but an imperfect idea of the effects of famine on fecundity and mortality on the population of the districts which were the chief sufferers. In the Hamirpur district, for example, the death-rate rose from a mean ratio of 39·05 during the previous five years to 61·83; and in Jalaun from 35·57 to 58·92. At the same time the birth-rate of Hamirpur district fell from a mean during the previous five years of 38·23 to 18·38; and that of Jalaun from 39·76 to 19·26. In the Hamirpur district there were 10,015 births registered against 31,887 deaths, or not quite one of the former to three of the latter; whilst in Jalaun, there were 11,403 births to 23,667 deaths registered, or less than one birth to every two deaths. In the other districts mentioned in paragraph 10 of the Report the effects were more or less similar; but of these districts, two, with death-rates of over 55 per mille of population, did not belong to the list of

those declared to be famine-stricken. The high mortality in these two was due chiefly to malarious fever "of a severe and persistent type." In neither of the two, however, did the excess of deaths over births come up to that recorded in the famine-stricken districts. In 76 of the 104 municipalities the deaths exceeded the number of births; and the urban death-rate, as a whole, was greatly higher than that recorded in rural tracts, the former having been 48·55 as compared with39·86 in the latter. In most of the municipal towns with high death-rates "the explanation lies in the fact that they were "the situation of poor-houses to which the beggars, lepers, and the generally submerged portion of "the population came too frequently only to die." The endeavour made to differentiate the causes of death by a professional agency led to the verification of 15,116 cases. Out of this number, only 1,587 deaths are attributed to remittent and intermittent fevers; but 3,345 are attributed to "other fevers." Even when the deaths from fevers of every kind are added together they form less than a third of the total deaths. On the other hand, the deaths diagnosed as due to bowel-complaints numbered 3,706 and formed nearly a fourth of the total; whereas in the returns for the Province, whilst the death-rate attributed to fever is recorded to have been 31·21, that attributed to dysentery and diarrhæa was only 1·25 per mille of population. From this it may be inferred that, whilst the reporting agencies greatly over-state the number of deaths due to fever, they greatly under-state those due to bowel complaints; a conclusion at which many medical and sanitary officers have arrived in other provinces. It is not to be expected that the ordinary village watchman can do much towards differentiating diseases, but what he can do he does well. Although he can generally neither read nor write, the accuracy with which he reports the births and deaths occurring within his beat is put beyond question by the results of the testing of the registration by local revenue, civil and police officers, and by members of District Boards. An examination by these agents of 148,015 entries of births went to show that a percentage of 2·79 had been omitted; and an examination of 179,149 entries of deaths, that a percentage of 2·43 was omitted. "The approximation of these results to those "of former years," writes Dr. Thomson, "may be held to point to the general accuracy of the returns." Verification by the vaccination staff was also, as in former years, extensively carried out. The percentage of omissions recorded to have been detected by this agency was small. In his previous report the Sanitary Commissioner explained what is probably the real cause of the small number of omissions recorded by vaccinators. As Dr. Thomson, in a previous report, stated: "The collection "of vital statistics for this vast area and population is carried on by the village watchman, the only "method possible with any regard to reasonable economy, and, upon the whole, it is wonderfully "well performed. Probably it is one of the most efficient reporting agencies, at the price, in "the world."

2. *History of Chief Diseases.*—The death-rate from *Cholera* was only equal to a ratio of 0·94 per thousand of population, as compared with 1·47 in the previous year, and with 2·16, the average for the five years preceding the year under report. This comparative immunity from cholera in a year of widespread famine and high prices is not a little remarkable. In our memorandum on the Sanitary Report for Bengal for the same year we noted that in Bihar, which was the most severely famine-stricken part of the Province, the mortality due to cholera was less than half that in the preceding year, and by far the lowest recorded in any division of Bengal. From this we ventured to draw the conclusion that there was no necessary connection between the existence of famine and the prevalence of cholera. The comparative freedom of the North-Western Provinces from cholera would seem to lend some support to such a conclusion. On the other hand, it cannot be overlooked that, under similar conditions of famine, the result was very different in other provinces. In Bombay the cholera death-rate was 3·03, in Madras 4·4, and in the Central Provinces 6·01 per thousand of population, as compared with only 0·94 in the North-Western Provinces and Oudh. Taking into account the vast numbers employed on relief works, and the privations which they must have endured inthe hot and rainy seasons, the immunity from cholera which the latter figures indicate is noteworthy. Onlyonce during the preceding eight years has it been as low as it has been during this year, when the conditions seemed favourable to its epidemic prevalence. But the measures adopted for dealing with outbreaks of the disease cannot be ignored as factors in bringing about this result. "It was mentioned in last report," writes the Sanitary Commissioner, "that in the careful preservation of the purity of the water-supply, the prompt "removal of the people from the infected area, and the breaking up of large bodies of people into "smaller units, lay the best prospect of coping with outbreaks of epidemic disease on relief works. "The experience of the past year has fully borne out this anticipation. Over and over again "cholera in an epidemic form has appeared on the works, but in all cases the procedure adopted "has succeeded in speedily extinguishing the outbreak." In short, the method of dealing with an outbreak of cholera in cantonments was modified and adapted to suit the different conditions prevailing on relief works, with the result that the soundness of the principle underlying the method received a fresh illustration and confirmation. Dr. Thomson thinks there is no doubt as to the utility of the disinfection of wells with permanganate of potash; but on this point there is still some difference of opinion. The Deputy Sanitary Commissioner, Dr. Chaytor-White, in describing the outbreak of a virulent form of cholera amongst the relief workers in the Allahabad district, says the Superintending Engineer spoke very highly of the effect of potassium permanganate and was inclined to attribute the decline of the epidemic to its use. Dr. Chaytor-White adds:—"The result, "however, is not sufficiently convincing to enable one to formulate a definite answer to the "question as to whether it was really a case of *post hoc* or *propter hoc*. Later experiments with "permanganate have shown anything but convincing results, and the matter may be said to be "still *sub judice*."

3. *Small-pox* accounted for 87,127 deaths, or more than twice as many as in the preceding year. The death-rate per mille of population was the highest caused by small-pox in the combined provinces since 1884. The Sanitary Commissioner suggests that the explanation of this increase in the year under report "is possibly to be found in the peculiar climatic conditions prevailing." These conditions may have had some influence, and the diffusion of infection may have been aided by the collection of people on the relief works, as well as by the wandering about the country in quest of employment and food of destitute persons, always a feature of a famine year; but more

potent than any or all of those causes was doubtless the insufficient protection of the population by vaccination. Of the eight districts which are stated in paragraph 43 to have suffered most severely out of the 48 which belong to the combined provinces, the 12 districts of Oudh furnished half. Vaccination in Oudh has lagged far behind vaccination in the North-Western Provinces; and to this cause is almost certainly due the fact that of its 12 districts half of them show small-pox death-rates above the provincial average; whilst in the 36 districts of the North-Western Provinces there are only 11 with rates above the provincial rate. The year was an unfortunate one for vaccination. The number of successful primary vaccinations fell from 1,308,941 in the previous year to 1,182,395; and the successful re-vaccinations from 52,421 in the former to 41,934 in the latter year. The percentage of successful cases in primary vaccination, in which the result was known, fell at the same time from 94·65 to 93·74 One of the reasons given to account for the decrease in the year's work was the low birth-rate. There were 201,440 fewer births registered than in the previous year. It is stated, also, that the reduced condition of the children rendered many unfit for operation. Of the adverse influence of these two causes there can be no question; but the prevalence of small-pox in 1896 and 1897, given as a third reason, except in so far as it reduced the number of persons in need of protection by vaccination, might have been expected to encourage people to resort for protection to vaccination, and especially to re-vaccination. The deputation of vaccinators on plague duty would, no doubt, dislocate their arrangements for the performance of their proper work, and would materially lower their season's record. Referring to Statement No. I. of the Vaccination Report for 1897, it is seen that the number of children under one year of age who were successfully vaccinated was 551,113. The number of births registered in 1897 was 1,458,947, and the number of children who died before completing their first year was 425,051, leaving available for vaccination 1,033,896. According to this calculation little more than half the number of children available were successfully vaccinated. Until the number of successfully vaccinated children under one year of age approximates more nearly to the number available for vaccination, the cessation of recurring small-pox epidemics need not be looked for. In the Bombay Presidency, in the year under report, 84·73 per cent. of the children under one year of age were successfully vaccinated, and the small-pox mortality for 1897 was equal to a ratio of only 0·20.

4. *Fever* was credited with 1,463,716 deaths, giving a death-rate per thousand of population of 31·21, as compared with 25·7 in the previous year. But there can be no doubt that this ratio is greatly enhanced at the expense of other diseases. Judging from the proportion of deaths certified as due to fevers by the independent medical practitioners mentioned in paragraph 22 of the Report, it may be inferred that, whilst the number of fever deaths would be greatly reduced by accurate diagnosis, the number caused by *Dysentery and Diarrhœa* would be correspondingly increased. In a year during which high prices and famine reduced large numbers of people to eke out a scanty dietary with unsuitable and unwholesome articles of food, the conditions known to be specially favourable to the causation of bowel complaints were unusually prevalent, and the 58,822 deaths attributed to these diseases represent probably but a portion of the real number. Of the fever which prevailed, Dr. Thomson remarks that "it is unsafe to definitely say more than that malarial " fever was of a severe type, and that the people generally were, from a reduced condition of health, " less able than usual to withstand it."

5. An interesting account is given of the campaign carried on against *Plague*, which effected an entrance into the Province, it is said, from Sind. The measures adopted with the object of preventing the disease from securing a permanent footing were successful. The entire number of deaths recorded as due to it from the time of detection of the first case on the 8th April until the end of the year was 73. Early detection and prompt segregation of first cases, followed by evacuation and disinfection of the houses in which the cases occurred, formed an essential part of the programme adopted with the object of circumscribing and stamping out the disease.

6. *Sanitary Works.*—Although, as stated in the Government Review of the Report, funds were but little available for expenditure directly on sanitary objects, the condition of a large number of villages was improved by the works undertaken in connection with famine relief, and in towns, apart from the large schemes still in hand, much progress was made in raising the standard of sanitation. At Benares progress is being made towards the completion of the sewerage of the city, and at Allahabad the extension of the filtered water-supply to Daraganj, near which the great religious fairs are held at the junction of the Ganges and Jumna Rivers, was taken in hand. Both works are of the utmost importance in their bearing on the health conditions of two cities subjected to special danger from importation into them of disease by pilgrims from all parts of India. Difficulties have arisen in connection with the waterworks of several of the large towns; but these are only such as might be expected to occur whilst waterwork schemes are still comparatively new to the country, and have already been, or are being, overcome. In these, as in the other Indian provinces, the fear of plague invasion has doubtless given a wholesome stimulus to sanitation. The Sanitary Commissioner writes :—" The sanitary condition of the principal centres of population in these provinces has received " an amount of attention which it has certainly never received before. It was part of the policy of " the Government for prevention of plague to render such centres as little likely as possible to prove " suitable breeding grounds for the disease." The difficulty, ever present in India, of counteracting the corruption of the official underling, came strongly into evidence in dealing with the plague crisis. " It may be said that the prevention of the abuses of power by lower subordinate officials has been " the greatest difficulty experienced in the course of the plague operations in these Provinces." More than a difficulty, it is a danger which can never be overlooked where the conduct of operations, such as those which may be called for in combating plague, gives opportunities to dishonest subordinates for the practice of oppression. In a valuable memorandum by the Sanitary Commissioner, given as an Appendix to the Report, it is satisfactory to read regarding the disposal of the sewage and refuse of towns :—" Water carriage and incineration hardly exist in these Provinces." The return to the soil of what has been taken from the soil is generally accepted as a sound principle; and sanitarians in most countries are coming to deprecate the wasteful discharge of the sewage of towns into rivers or the sea, as well as the destruction by fire of refuse which should enrich the soil. The new

Annual Form XI. appended to the Report, if revised from year to year, will form a useful record of the progress being made in the sanitary improvement of the 104 municipalities of these provinces.

7. Briefly, the year was a trying one from a health point of view. The premature cessation of the rains in 1896 caused failure of the crops. High prices and famine resulted in severe and wide-spread distress. The climatic features of the season were not more than ordinarily unfavourable to health, and, after the setting in of an abundant and seasonable monsoon, good harvests followed, with speedy restoration of prosperity. Immediately succeeding a season of drought and privation, the year under report showed a marked decrease in the birth-rate, and a still more marked increase in the death-rate. The deaths exceeded the births in number by 438,645. Enfeebled by prolonged privation, many succumbed to complaints from which, in ordinary years, they would have recovered. Contrary to what might have been anticipated, cholera was less fatal than during the previous year, and the death-rate due to it was lower than the mean for the previous five years. In accounting for so satisfactory a result, the measures adopted with the object of preventing outbreaks of the disease, and cutting them short when prevention failed, should not be overlooked. Small-pox carried off 87,127 persons. The Sanitary Commissioner suggests that the climatic character of the year may have been concerned in exciting so severe an epidemic. To some extent the suggestion may be well-founded; yet there can be no room for doubt that the main cause was the insufficient protection of the population by vaccination. Approximately, half a million of the children under one year of age available for vaccination were not vaccinated. Until the number of infants successfully vaccinated more nearly approaches the number of infants available for vaccination, the periodical recurrence of small-pox epidemics is not to be looked for. Malarial fever of a severe type caused a high mortality; but it is certain that large numbers of deaths attributed to fevers were really due to other diseases. Dysentery and diarrhœa are recorded to have caused only 52,822 deaths; and reasons are given for believing that the actual number of deaths due to these diseases, in a season when high prices and scarcity drove many of the poor to eke out their dietary by unwholesome articles of food, was much greater. Although plague effected an entrance into the Province, the measures adopted with the object of preventing its spread fortunately proved successful. New sanitary works on an extensive scale could not have been undertaken during a year in which the resources of the State and of Municipalities were severely strained in the struggle with famine and pestilence; but the fear of a plague invasion gave a healthy stimulus to the cleansing of towns, and the Sanitary Commissioner thinks the sanitary state of these has had a greater amount of attention bestowed upon it than it has ever had before. Even from the calamities of the year some compensating benefits have been thus reaped. As the Sanitary Commissioner concludes his Report by observing: "The mortality, though "far below what might have been reasonably expected, has been in the nature of things high. "Regrettable as this unavoidable mortality is, there are circumstances from which the social economist "may glean satisfaction. A low birth-rate means fewer mouths to fill, and consequent better "nourishment of the children; while the expectation of life may be expected to increase in a "population from which the diseased and pauper elements have been so largely eliminated."

9th June 1899.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1897.

The volume containing the Report, its Appendices, Map and Government review is of little more than half the bulk of its predecessors. This decrease in size is owing mainly to the substitution of the present Annual Form II., covering six pages, for that previously in use covering upwards of eighty. The Sanitary Commissioner's Report, contained in 24 pages, is concise and deals only with what is essential. The year was a fairly healthy one. Like other provinces, the Punjab had its famine areas; but these were of limited extent, and early and effectual measures for the relief of distress were adopted. The average rainfall for the province was considerably less during each quarter of the year than the average for the corresponding quarters of the previous ten years. Prices of grain ruled high in the Punjab, as they did all over India; but although relief operations were undertaken over 12,000 square miles with a population of 3¼ millions, famine only reached the acute stage in one district.

2. *Vital Statistics.*—Again, the birth-rate of the Punjab was higher than that recorded in any other province of India. The Sanitary Commissioner attributes this, in part at least, to the system of check of registration by the vaccinators and divisional inspectors. It appears from the tables given in paragraphs 28 and 29 that out of a total number of 874,623 entries of births made during the year, the very great number of 608,714 were checked by the vaccinators and divisional inspectors; and that 10,792 births of males and 10,144 births of females were discovered by these agents to have been omitted from the registers. At the same time, 198,150 entries of deaths of males and 173,608 of females were checked, with the result that 4,465 deaths of the former and 4,478 of the latter were discovered to have been omitted. The testing by the divisional inspectors seems to have been by far the most thorough, judging by the number of omissions discovered by them in proportion to the number of entries examined. To this systematic check of the village watchmen's books there can be no doubt that Dr. Roe is justified in assigning in great part the improvement which has been, and is being, made in the registration of vital statistics in the Punjab. By way of contrast, the statement of the results of inspection carried out by tahsildars and assistant tahsildars may be put

side by side with the results recorded by divisional inspectors. Whilst the former officials detected only 1,725 omissions of births of males and 1,620 of females in 15,562 villages, the divisional inspectors detected 4,948 omissions of births of males and 4,873 of females in 4,746 villages. As the Sanitary Commissioner remarks of the testing of registers by the former officials, "their work "in this respect was far from satisfactory." And this need not be wondered at: officers such as tahsildars and their assistants, with other multifarious duties to attend to, cannot devote the time necessary to thoroughly test the registration of births and deaths entry by entry. In calculating the total number of entries tested by the several agencies, the error must not be made of concluding that each entry, recorded as tested, represents a separate birth or death. Although not so stated, it may be inferred that the same entries were tested in some of the villages by more than one of the several inspecting agents. If this inference is correct, the total combined number of entries returned as examined by the several inspecting agents would, of course, exceed the actual number of entries of births and deaths, seeing that some of these had been tested and counted more than once. Adding up the total number of villages inspected, according to the tables given in paragraphs 27, 28, and 29, it is found that they aggregate 52,295. But there are only 37,602 villages in the province, and therefore 14,693 villages must have been inspected more than once. It would thus appear that, the same villages having in some cases been inspected more than once, the same entries in the watchmen's registers may likewise have been inspected more than once. This, however, although probable, does not necessarily follow.

3. The number of births was less than the number in the previous year by 10,069, but exceeded the deaths by nearly a quarter of a million, or 11·5 per thousand of the population. From this it appears that the localised prevalence of famine in the Punjab did not sensibly check the natural increase of the population, which was, for the province as a whole, the same as in the preceding year. But where acute famine existed, as in Hissar, the only district in which it did exist, the results for the province were reversed; the deaths exceeded the births, and the population, instead of increasing, considerably decreased. There was in Hissar district an excess of 8,883 deaths over births. Scarcity acted here in both directions, reducing the birth-rate from a mean of 43·4 during the previous five years to 33·9 during the year under report; and raising the death-rate from a mean of 32·1 during the previous five years to 45·3. Although registration of births is making progress in the frontier districts it is still very backward in certain of them, such as Peshawar and Hazara. In these latter, the registration of births, of female children more especially, is defective. In one rural circle the ratio of male to female births was recorded to be 189·3 of the former to 100 of the latter; and in other three circles the ratios exceeded 140 to 100, the ratio for the Punjab as a whole having been 110·5 to 100.

4. The *death-rate* for the year, which in spite of high prices and local famine was a healthy one was 31·05 per thousand of population as compared with 31·53 in the previous year. It has already been noted that the birth-rate was the highest recorded in any province of India. A high birth-rate is the ordinary accompaniment of a high death-rate; but such was not the case in the Punjab, in which the death-rate was 31·05 as compared with 32·94 in Bengal, 39·84 in Bombay, 40·46 in the North-Western Provinces and Oudh, 50·61 in Assam, and 69·34 in the Central Provinces. The death-rate recorded in the Madras Presidency was only 25·4; but seeing that famine in an acute form prevailed over extensive areas of that province, this rate, although useful for comparison with the rate of 20·6 recorded in itself in the preceding year, can hardly be regarded as even approximately representing the actual rate. The district of the Punjab which returned the highest death-rate was Dera Ismail Khan. In this the rate was 50·2 as compared with 45·31 in Hissar, although, unlike the latter, it did not suffer from famine. Turning to pages vi. and vii. of the Appendix to the Sanitary Report, it will be seen that "the principal sanitary defects" recorded for this district would not suggest unhealthiness. Of the drainage it is stated that it was "good and "satisfactory," of defects in water-supply that there were "none," that conservancy was "improving"; whilst the "measures taken for sanitary improvement of district" were "some wells "cleaned out and parapets made."

5. To the *Chief Diseases* hitherto dealt with, a new one has been added. Plague, according to the Sanitary Commissioner's account, was introduced into the province by a Brahmin, who had been on a pilgrimage to Hardwar and returned on the 29th of April to his village in the Jullundur district, where he died after a few days' illness. Whilst admitting that the disease may have been introduced in the way described, the Lieutenant-Governor does not think this certain, and adds:—"it seems "quite as probable that the Rawals, who have a home in Khatkar Kalan and who are notorious "wanderers, may have brought plague with them from Poona or Bombay." It was not until the month of October that the disease declared itself in epidemic form. Up to the close of the year there were altogether five villages attacked, four in the Jullundur and one in the Hoshiarpur district. The total number of seizures was 302 and of deaths 175. The village of Khatkar Kalan, when the disease was officially announced to be plague, had a cordon placed round it, with the view, doubtless, of isolating it. Whatever may have been the effect of the cordon on the progress of the epidemic, it is certain that the effect of the next step taken was marked. "During the following "week the entire population of the village were turned out into camp, and hutted within the "village area." The efficiency of this method of dealing with plague has from the first been amply demonstrated; and science, although usefully supplementing it, has so far failed to provide a method of treatment which in point of efficacy has superseded it. Unfortunately, it cannot always be carried out as it is desirable that it should be. In the case of a great city like Bombay thorough evacuation would obviously be impracticable. Where, however, it is practicable, and can be carried out early and in a thorough manner, it still holds its place as the most effectual means yet tried of arresting the disease.

6. *Cholera* was confined almost entirely to Hissar, the one district of the province in which acute famine prevailed. Of the total number of 622 deaths caused by it in the entire province, 538 occurred in Hissar alone. As showing the limited area affected, it is stated that cases of the disease were reported in only 31 out of the 37,602 villages in the province. The water-supply in some cases,

and importation of infection by travellers in others, were usually credited with causing the outbreaks; but the evidence in support of these statements is too meagre and vague to be very convincing.

7. *Small-pox*, which was so prevalent and fatal last year, when it swept off 45,084 persons, caused 16,077 deaths in the year under report. Having now killed, or left protected against further attack, most of those who had not already had the disease or been vaccinated, small-pox may, in accordance with its usual behaviour, probably remain more or less in abeyance until a further re-accumulation of susceptible material has had time to take place. The fatal epidemic of last year should serve as a warning against remaining satisfied with the amount of protection hitherto being conferred under the system of vaccination in force. As the Sanitary Commissioner points out, the death-rate from small-pox in a large number of municipal towns was excessive, "which indicates clearly that "vaccination work in them is neglected." Unfortunately, the work of the Vaccination Department for the year 1897–98 shows, instead of an increase, a serious decrease of no fewer than 56,922 cases. According to Statement No. I. of the Vaccination Report, the number of children under one year of age successfully vaccinated was 475,929. There were 874,623 births recorded in 1897; and the deaths of children under one year of age numbered 202,577. Deducting the latter figures from the former, there would remain available for vaccination 672,046. Of these, 475,929 were successfully vaccinated, leaving an unprotected residuum of 196,117. Even when allowance is made for a certain proportion unfit for vaccination, on account of feebleness or illness of some kind, it will be plain that, with nearly 200,000 children remaining unvaccinated of those born in a single year, the danger of a recurrence of a small-pox epidemic at no very distant period is more than a probability. With so many infants unprotected by vaccination, the record of 213,717 cases of re-vaccination seems to suggest that it might have been preferable, had some of the attention devoted to re-vaccination been given to increasing the amount of primary vaccination. The Sanitary Commissioner writes: "The Civil Surgeons attribute the great falling-off in the number of primary "vaccinations chiefly to the high mortality among children during the year, and partly to the failure "of lymph and carelessness of the vaccination staff." It has, however, been shown that, when the number of children under one year of age who died is deducted from the number born, there remained nearly 200,000 available for vaccination, but who were not vaccinated. The quality of the lymph used is of vital importance. Human lymph in primary vaccination gave a per-centage of 98·2 successful cases, and animal lymph of 99·3, whilst vaseline lymph gave a per-centage of only 94·3. On the other hand, vaseline lymph gave the second highest per-centage of success in re-vaccination, a per-centage (75·6) which suggests that it did not fail to produce some form of local irritation, which the vaccinators considered themselves justified in entering in their registers as "successful." We have more than once expressed some scepticism when these high per-centages of successful cases in re-vaccination have come before us. The opinion of an officer of great experience, the Sanitary Commissioner of the Hyderabad Assigned Districts, noted in our memorandum on his report, is deserving of consideration in this connection.

8. Fevers and bowel complaints were somewhat more fatal than in the previous year. The ratio of deaths *per mille* of population from fevers was 20·57, as compared with 19·15 in 1896; and the ratio from dysentery and diarrhœa 0·77. In Hissar, the one district in which acute famine prevailed, the ratio of deaths due to fevers was 34·23, and from bowel complaints 2·02. The latter ratio was not reached in any other district of the province; but the fever death-rate was exceeded in Dera Ismail Khan and in Muzaffargarh, districts in which famine conditions did not prevail. The fevers were of malarial type. Hitherto, the sale of quinine through Postal Agency in rural tracts with the object of combating fever has not in the Punjab been a success; but the Lieutenant-Governor thinks it should not be abandoned without further trial, and proposes to continue it under modified conditions which it is hoped may render it more successful.

9. *Sanitary Works.*—Some progress was made in providing and improving water-supplies for towns. Under this head an expenditure of considerably over two lakhs of rupees was incurred; whilst upwards of one lakh was expended on drainage works. With the view of encouraging village sanitation, the Lieutenant-Governor desired that the experiment might be tried of a District Board offering to pay a considerable fraction of the revenue demand of the one village in each tahsil which showed the best results during the current year (1898), the adjudicators being the Deputy Commissioner and the Civil Surgeon aided by one or two native officials. The Sanitary Commissioner is asked to bear in mind that a full report of the action taken and its results is to be submitted as early in the year 1899 as possible. The experiment seems promising. If the people can be induced by the hope of reward to keep their villages clean, the introduction of legislative measures followed by punitive proceedings, with their attendant opportunities for oppression and extortion by underlings, would be avoided. Only one meeting of the Sanitary Board was held during the year at Simla, when papers regarding the excessive death-rate from fevers and other kindred matters were considered.

10. Briefly, the year was on the whole a healthy one. Although high prices prevailed in the Punjab as in other parts of India, acute famine was confined to the one district of Hissar. In this district the effects of famine were marked by a diminished birth-rate and a greatly increased death-rate—the deaths exceeding the births by 11·4 per thousand of population; whilst for the province as a whole the births exceeded the deaths by 11·5. Registration of vital statistics, as judged by results, is probably as efficiently carried out as in any other province of India. Plague made its appearance in the Punjab, and by the end of the year had attacked five villages and proved fatal to 175 of a total number of 302 persons seized with it. The mode of the introduction of the disease is not altogether certain. The efficacy of early and complete evacuation of the infected villages in arresting the disease was clearly demonstrated. Cholera was mostly confined to the famine-stricken district of Hissar, in which it proved fatal to 538 persons out of a total number of 622 who died of it in the province. Small-pox, which was excessively fatal during the preceding year, was credited with 16,077 deaths in the year under report. Unfortunately, a serious decrease

in vaccination work is recorded for the year 1897–98. This decrease is attributed, in part, by Civil Surgeons to the great mortality amongst children ; but when the recorded deaths of children under one year of age are deducted from the recorded births, it is seen that the remaining number available for vaccination exceeded the number successfully vaccinated by nearly two hundred thousand. With so large a residuum of infants in need of vaccination, the wisdom of devoting so much attention to re-vaccination seems to be open to question. There were 213,717 cases of re-vaccination. Fevers and bowel complaints were somewhat more fatal than during the previous year. The experiment for placing quinine within easy reach of the people for purchase is to be continued under modified conditions. Sanitary works made some progress. The Lieutenant-Governor desires to try the effect of offering rewards to induce villagers to improve the sanitary state of their villages.

9th June 1899.

No. 5.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1897.

In Burma, as in India, failure of the rains of 1896 was followed in part of the province by scarcity and famine. The tract of country affected lies in Upper Burma, in which arrangements for the systematic collection of vital statistics do not yet exist. The effect of the famine on the health of the population cannot therefore be ascertained with any approach to certainty. The relief afforded to the famine-stricken districts by the State was so prompt that the mortality directly due to privation was probably not great. Under the pressure of scarcity, more than a third of the population of the affected tract migrated to Lower Burma, where they found employment and relief. One result of this famine has been to draw the attention of the Government to the urgent need for the extension into Upper Burma of the system of registration of births and deaths in force in Lower Burma, in order that, in the words of the Lieutenant-Governor, "there may be due "warning of the approach of scarcity, and that the severity of such calamities may be gauged." The Government proposes to introduce the system of registering deaths in the more civilized areas of Upper Burma, with effect from the 1st January 1899. "The registration of births will not be "attempted." But, as no separate agency is needed for the registration of births, the same agents in Lower Burma registering both births and deaths, it seems a pity that a commencement should not be made of registration in Upper Burma on the same complete system as that which is making so satisfactory progress in Lower Burma. The inclusion of births would add comparatively little to either the labour or cost of registration of vital statistics ; whilst it would almost, or altogether, double their value. In the opinion of the Chief Commissioner of the Central Provinces, quoted in another memorandum, a reduction of the birth-rate in a tract of country may be accepted "as almost "conclusive evidence of the prevalence of pressure on the labouring population."

2. Except in Mandalay and three other municipal towns, vital statistics are not as yet recorded in Upper Burma, and even in Lower Burma there are still districts and parts of districts in which registration is not in force. The portion of Lower Burma for which vital statistics are available contains a population, according to the last census, of 4,514,773. Calculated on this number, the *birth-rate* for the year was 31·82 *per mille*. During the preceding year the rate was 32·27, or a fraction higher. No doubt the real birth-rate is considerably higher than the recorded birth-rate. This is shown by the results of the inspections carried out in towns and districts of the province. These inspections, to judge of them from the tabulated statement on pages 2 and 3, were carried out only to a very limited extent, and in some cases with no great thoroughness ; but what of evidence they afford goes to support the conclusion that many births and some, though fewer, deaths remain unregistered. Revised rules relating to registration are published in an Appendix to the Report ; and, in the opinion of the Lieutenant-Governor, appear now to be "theoretically perfect." The best proof of the improvement which is being effected in the working of the rules is the steady decrease in the numbers of births and deaths which are omitted from the registers. From a record of only 18·45 births per thousand of population in 1873, a rate of 31·82 is recorded in the year under report. During the last six years the improvement has been more steady and rapid than in preceding years. The quarterly review by the Sanitary Commissioner of the provincial statistics published in the official Gazette will be useful in calling attention to returns of births and deaths which markedly deviate from normal. Commissioners are enjoined by the Government to make full inquiry into the causes of such deviations, and to adopt the proper remedy where the registration is found to be faulty. The differences between the birth-rates recorded in some towns are remarkable. Rangoon shows a ratio of 17·61, and Bassein a ratio of 35·19, *per mille* of population. In the case of Rangoon, as in the case of Bombay, the explanation given of the low birth-rate is the small proportion of females to males in the population. According to class, the birth-rate varies still more widely. Whilst amongst Burmans or Buddhists the recorded rate is 33·47, it is only 8·57 amongst Hindus.

3. The *deaths* registered were equal to a rate of 26·26 *per mille* of population, against 23·63 in the previous year and a mean of 22·27 for the past five years. The rate has continued to increase from 15·22 in 1873 to 26·26 in the year under report. In urban areas it was 32·34, as compared with only 25·33 in rural areas. These rates are considerably higher than those recorded in the preceding year, and than the mean of the preceding quinquennium. The increase was chiefly due to cholera and "other causes," but doubtless also in part to improvement in registration. Amongst children

under one year of age the increase was marked. The death-rate amongst male children of this age was 269·24 *per mille*, as compared with 235·90 in the previous year; and amongst female children 188·24, as compared with 169·44. According to class, the highest death-rate took place among Hindus. It has already been seen that amongst these, the lowest birth-rate was also recorded. The Sanitary Commissioner explains that the Hindu population of 141,526 is chiefly made up of coolies "who from the nature of their occupation are specially liable to early breakdown." It is presumed that these coolies are chiefly males who have emigrated from India without taking their wives with them. If so, this would help to account for the almost incredibly low birth-rate of 8·57 recorded for the Hindu population. On page 10 of the Report a useful statement is given of the meteorological records for the year, of the mortality from four of the chief diseases, and of the average price of food-grains in the four districts of Rangoon, Toungoo, Tavoy, and Mergui. "According to this statement," writes the Sanitary Commissioner, "the districts with the least "mortality have a more equable temperature, a northerly wind, a much greater rainfall, and a "cheaper staple food-grain; whilst the districts in which the mortality was highest are characterised "by a less stable climate, southerly wind, a much smaller rainfall, and higher priced grain. But "considering the fact that heavy rainfall is an undoubted cause of sickness, and that the range of "temperature in the different groups is not a striking feature, the inference is inevitable that faulty "registration rather than meteorological conditions were responsible for the apparent comparative "healthiness of Tavoy and Mergui."

4. *Chief Diseases.*—The mortality from *Cholera* was the highest recorded since 1888. The disease was wide-spread, affecting all, except three, of the districts of Lower Burma, and prevailing throughout the year, although most fatal in March, April, May, and July. As the Sanitary Commissioner says, it is almost impossible to trace the history of an epidemic of the disease as regards its origin and mode of spread in a country like Burma, where cholera is ever present in one form or another. The truth of this is exemplified by the account given, in paragraph 33, of the variety of conclusions arrived at by District Medical Officers. One is unable to state whether the disease was imported or originated locally; another asserts that it was brought into his own district from another; in two districts the disease was ascribed to the use of river water; whilst the Health Officer of Rangoon attributes it there to the use of tank water, and states that changing the water-supply in the case of two outbreaks promptly checked the epidemic. In six districts no cause could be traced to account for the appearance in them of the disease; whilst in a seventh the influx of coolies from Chittagong is credited with its introduction and spread. In short, another year's observation of cholera in Burma has added little of value to our knowledge of its origin and mode of propagation.

5. *Small-pox* was accountable for 1,950 deaths, or a ratio of 0·43 per thousand of population, and was somewhat more fatal than during either of the three previous years. Of the deaths 19 per cent. occurred amongst infants under one year of age, 46 per cent. amongst children between one and 12 years, and the remaining 35 per cent. among persons over 12 years. There seems to be a consensus of opinion that in Burma the practice of inoculation is responsible for the majority of the outbreaks of small-pox. Of the 181 deaths caused by the disease in the towns of the province, no fewer than 137 occurred in Rangoon and Moulmein. In the case of both of these towns, the introduction and spread of small-pox are attributed by the Health Officers to the unprotected Coringee coolie emigrants. It has been found difficult to put a stop to surreptitious inoculation in countries in which it has been practised from time immemorial, and it will no doubt be difficult to stop it in Burma until the people come to recognise that vaccination, the substitute for it, is equally effectual as a protection against small-pox, and at the same time simpler, attended with less suffering to the person operated on, and without risk to this person's neighbours. The circumstance that vaccination may be had for nothing, whilst inoculation is attended with considerable expense, would give the preference to the former in the case of the poor; but those able to pay for it would probably still prefer inoculation, consecrated as it is by ancient custom and performed with mysterious religious rites. As regards the introduction of small-pox by immigrant coolies into Rangoon, the Lieutenant-Governor believes the danger "will "be sufficiently guarded against if power is taken to vaccinate unprotected persons on board ship on "which small-pox has occurred and unprotected inmates of a lodging-house or a cooly barrack, and "also to serve notice upon any unprotected person to be vaccinated within seven days. Provision to "this extent has accordingly been made in the new Vaccination Bill, which it is intended to introduce "at the next meeting of the Legislative Council." Taking, however, into consideration the fact that the period of incubation of small-pox is from 10 to 16 days, and that the voyage from India to Rangoon is greatly less, it might well happen that coolies infected before embarkation would not develop the disease until some time after landing in Rangoon. Unless such persons were detained under observation in Rangoon, they might become the means of introducing the disease amongst the inhabitants, or of carrying it with them and spreading it in the country beyond. If recruitment were not discouraged thereby, it would seem safer to insist on coolie emigrants being vaccinated or re-vaccinated before embarkation for Burma. Quoting from the Resolution of Government on the Annual Report on Vaccination for 1897–98 :—"The vital statistics of 1897 show that the mortality from small-pox was greatest in districts near the capital." The inference is clear, and in accord with the opinions expressed by the Health Officers of Moulmein and Rangoon, as to the part played by immigrant coolies from India in the importation and dissemination of small-pox. In the present Report, the vaccination returns for Upper Burma, instead of being shown separately as heretofore, are, in accordance with the instructions of Government, incorporated with those for Lower Burma. The total number vaccinated during the official year 1897–98 was 421,786, as compared with 414,845 in the previous year; whilst the percentage of successful cases at the same time increased from 92·43 to 94·56 in primary cases. Of successful cases of re-vaccination the percentage likewise increased from 59·50 in 1896–97 to 61·38 in the year under report. The ratio per thousand of population successfully vaccinated rose from 46 to 48. These figures show that satisfactory progress is being made; but, as the Sanitary Commissioner remarks :—"Infant vaccination, though showing improvement, falls far short of the estimated births." The increase in the number of children of this age vaccinated over the number vaccinated in the preceding year was 6,494. An unfavourable feature in

the season's work is its continued decrease in Rangoon: since 1894–95 vaccination work has steadily declined both in quantity and quality. The fatality of small-pox in that city is probably more than a coincidence of this decline. The Sanitary Commissioner gives a very useful table at page 4 of the Notes on the Statistics of Vaccination in Burma for the year. In this table are shown the number of births in municipal towns, the number of deaths amongst children under one year, the number of survivals available for vaccination, and the number of children under one year successfully vaccinated. This return might be adopted with advantage in the provinces of India.

6. *Fever* mortality was about the same as during the preceding year. From a total of 19,964 deaths credited to fever in 1873, the number has increased to 51,752 in the year under report; but this large increase is doubtless rather the result of improved registration of vital statistics than of greater fever prevalence. The Sanitary Commissioner attributes the lower fever death-rate in towns, as compared with rural areas, to the drainage and sanitary requirements of the former being better attended to than those of the latter. Perhaps, also, in towns the diagnosis of disease may be more intelligently effected, and deaths, which are erroneously entered under the heading of fever in rural areas, credited in towns to other diseases. Although the scheme for the sale of quinine in the interior of the province has not as yet achieved much success, the Government considers that the results are encouraging in some districts, and desires that district officers will persevere steadily in their efforts to popularise the use of the drug.

7. *Bowel Complaints* caused about the same number of deaths during the past as during each of the three preceding years. "The study of the seasonal incidence of the disease," writes the Sanitary Commissioner, "is very interesting from an etiological point of view. The disease was most fatal "and probably most prevalent in the rainy season from June to September, less so in the hot and "comparatively dry season from March to May. In January and December (the cold months) there "was a further fall in the death-rate from this cause, whilst in October and November, when the "weather was moist and equable, the disease became least fatal."

8. *Sanitary Works.*—No sanitary works of importance were undertaken during the year. The description given of the sanitary condition of some of the larger towns, shows that their most pressing requirements are a good water-supply and an efficient system of drainage; but these are costly requirements, and the practical difficulty in the way of providing them is the want of funds. Mandalay, the largest city according to population, in the province, is still, as regards sanitation, in a very primitive condition. The description given of it on page xxxv. of the Appendix shows that it needs a good water-supply, drainage, and a civilized conservancy system. The last is perhaps the most urgent want, and is now engaging the attention of the authorities. Of Rangoon, the second largest town according to recorded population, the Sanitary Commissioner writes:—"Nothing practical was done during the year to improve or extend the municipal water-supply." Some 65,000 to 70,000 of the inhabitants have still to depend for their water needs on wells and tanks, the majority of which, from their situation and surroundings, are dangerously liable to contamination. In the Appendices full instructions are given for the preparation of their Annual Sanitary Reports by District Medical Officers and Health Officers, as well as a list of the points which should be noted in the Permanent Sanitary Record, which it has been decided to introduce. As guides to those concerned, the instructions and list will doubtless be useful.

9. Briefly, a portion of Upper Burma was overtaken by famine in consequence of crop failure. Except in a few towns, arrangements are not yet in force for the registration of vital statistics in this part of the province, and, consequently, the severity of the famine cannot be gauged by its effect on fecundity or mortality. The Government has now determined to extend to Upper Burma the system of registration which is proving so successful in Lower Burma, but to confine it to a record of deaths only. Cholera mortality was the highest recorded since 1888. The history of the disease during the year adds nothing of practical value to what is already known regarding it. Small-pox was not more than usually fatal. Outbreaks are attributed in the majority of cases to the operations of inoculators, and, in the port towns of Rangoon and Moulmein, to importation of infection by coolies from India. A new Vaccination Bill is about to be introduced, which, the Government believes, will sufficiently guard against the danger of infection being introduced by immigrant coolies. Vaccination made satisfactory progress, but the number of infants vaccinated is still greatly less than the number available for vaccination. More deaths were recorded as due to fevers than during any previous year, a result doubtless due, in part at least, to improvement in the registration of vital statistics rather than to increased fever prevalence. Steady effort is being made to promote the sale of quinine. No sanitary works of importance were executed during the year. In Burma, as in India, the want of funds is the main obstacle in the way of sanitary progress.

9th June 1899.

No. 6.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the CENTRAL PROVINCES for 1897.

The history of the year may be said to be the history of the destructive famine officially declared to have set in towards the end of 1896. The succession of bad harvests which led up to this famine reduced the vital stamina of the people, and weakened their resistance to the diseases which usually accompany and follow famine. The mortality of the year was great, and, but for the relief afforded by the Government, would undoubtedly have been much greater. Out of a population of nine and

a half millions, according to the census of 1891, the number of persons in receipt of relief from the State had risen in the month of May to 691,890. Meteorologically, the year is described as one of high monthly mean temperatures and of a rainfall below the mean of the past 31 years. Under such conditions, whilst the death-rate increased beyond that of any previous year the birth-rate showed a marked decrease. The Sanitary Commissioner estimates the population of the provinces in the middle of the year to have been only 9,372,275, as compared with an estimated population of 9,716,419 in the middle of 1894.

2. *Vital Statistics.*—The birth-rate has steadily decreased from 38·82 per thousand of population in 1894 to 26·83 in the year under review. The decrease accompanied, and may be taken as some measure of, the pressure of the hard times caused by a succession of bad harvests. The normal birth-rate is probably rather above than below 40 per thousand of population, and in the year 1881 the rate recorded was 48·94. The mean of the decennium 1881–90 was 41·56. So constant is the influence of diminished prosperity in reducing the birth-rate, that the Chief Commissioner last year stated his belief that such decrease might be accepted "as almost conclusive evidence of the prevalence of pressure on the labouring population." In one district only during the year did the number of births exceed the number of deaths; and in the exception, Sambalpur, neither famine nor scarcity prevailed. In the provinces as a whole the deaths exceeded the births by 403,849. In some districts the mortality was very great. In Bilaspur the death-rate recorded was 95·54, and in Mandla 98·36. Both districts consist largely of hilly and jungle-covered tracts inhabited by a shy and scattered population. Both suffered severely from famine, and the Government experienced the greatest difficulty in providing the inhabitants with adequate relief. During the year, the number of births reported in the Mandla district was only 5,553, whilst the deaths numbered 33,383. There were thus six deaths to every birth. The destructive effects of the famine, and of the diseases which accompanied and followed it, can better be realised from these figures than from any description. Whilst, however, such havoc was being wrought amongst the people, it is doubtful if the work of registration of births and deaths could have been so efficiently carried on as in ordinary times; and it is more than probable that the figures recorded do not include all the births or all the deaths. In the municipal town of Mandla, with a population of 5,057, registration of vital statistics is compulsory: and during the year 1,208 deaths, equal to a ratio of 238·87 per thousand of population, were recorded. These deaths did not, however, all occur amongst the ordinary inhabitants of the town; the majority of those who died were probably famine-stricken wanderers who had come to Mandla in quest of relief. No fewer than 813 of the deaths are stated to have been due to bowel complaints: in other words, to diseases to which the famine-stricken are specially prone. In times of distress such as those which prevailed in the Central Provinces, although all suffer, the feeblest naturally suffer most. Of children under one year of age, 101,969 died out of a total of 268,732, or a ratio of 400·00 per thousand. The unusual heat which prevailed until the setting-in of the rains in June, contributed to the mortality amongst the people exposed to it on the numerous relief works. With the setting-in of the rains, followed by the reaping of the autumn crop in October, the condition of the population underwent amelioration, although even as late as the end of November there were still 151,446 persons in receipt of relief and the mortality continued in many districts to be very high, fever and bowel complaints carrying off numbers who had become enfeebled by severe and prolonged privation.

3. *General History of Chief Diseases.*—Excepting from small-pox, there was an increase of mortality from all of the other chief diseases. The greater part of the increase, however, was due to fever and bowel complaints. It might have been expected that during a year of acute and wide-spread famine, crimes of violence and deaths resulting from them would have shown a marked increase. But, as a matter of fact, deaths arising from wounding and accident increased only from 3,847 in the preceding year to 4,753 in the year under report. It is not perhaps surprising that deaths from suicide, which during the two previous years of privation had increased from 800 in 1894 to 1,044 in 1895, and to 1,161 in 1896, rose in 1897 to 1,424.

4. *Cholera* accounted for 57,131 deaths, or a ratio of 6·01 per thousand of population. Although during the preceding ten years this number has never been reached, yet over fifty thousand deaths from the disease were recorded in 1889 and again in 1896. Only in 1869 has the cholera death-rate exceeded that of the year under report. The seasonal incidence of the disease did not differ to any marked degree from that ordinarily observed during epidemics in the Central Provinces. The month of greatest fatality was June. From January, during which only 283 deaths were recorded, the disease increased in fatality, until in June it was credited with 21,125 deaths. Then followed a rapid decline in the number to 5,243 in July, to 1,960 in August, and to only 51 in December. The first two and last four months of the year were those of least cholera prevalence. Its increase during the first six months was accompanied by unusual heat and dryness. It was not until the 22nd of June, according to the reports of the Commissioner of Settlement and Agriculture, that monsoon conditions were established. The subsequent months were marked by a rapid subsidence of the epidemic. Large collections of people on relief works, many of them in reduced health and suffering from derangement of the digestive system due to insufficient and unsuitable food, doubtless favoured cholera outbreaks. The Sanitary Commissioner gives a brief summary of the district reports on cholera. The endeavours made in some districts to account for outbreaks by tracing them to importation of infection are not very successful. An example or two may be given in illustration of this. In the Narsinghpur district "the disease first made its appearance on the 8th February in " the Gorakhpur outpost to the south-east of the district, and is said to have been introduced by a man " who had been to the Chindwara bazaar." In the Khandwa district "the infection is said to have " been brought from Gogaipura on the border of the Berars, where some men from the Gondwana " tract had gone out to cut bamboos." Obviously, it would be unsafe to base conclusions regarding importation of the disease on such evidence. During a year in which cholera was diffused over the length and breadth of the provinces, search for the entrance into districts of first cases to account for the infection of those districts would not be likely to be often successful. Efforts to trace the origin of outbreaks in jails or lunatic asylums, in which the inmates are under close and constant observation, might be expected to afford the best opportunities of

arriving at exact conclusions. But although cholera appeared in seven jails, we find regarding two of those no opinion expressed as to the cause of its appearance; in a third "the medical officer was "not able to find out how these prisoners contracted the disease"; whilst regarding a fourth we read :—"It is stated that a careful investigation showed that the poison was most likely communicated "by the compounder attached to the poor-house dispensary, who attended cholera cases there, and "thereafter gave in the morning the prophylactic dose of cinchonidine sulphas to prisoners in jail." In the remaining three jails, the medical officer of one of them failed to trace the origin of the disease; whilst in the other two, its introduction was believed to be due to the arrival in jail of prisoners from infected localities. In many of the districts the dissemination of the disease is attributed to water; but the Civil Surgeon of Chindwara "is of opinion that the spread of the disease "could not have been due to the water-supply. He thinks it due to personal contact." In every district the disinfection of wells by permanganate of potassium was carried out during the year, and a *résumé* of the reports submitted on this subject is given in an *appendix* to the Sanitary Commissioner's Report. The statements made in these district reports show that, while some Civil Surgeons are satisfied that disinfection is successful in stopping outbreaks of cholera, others give doubtful or unfavourable opinions, and the rest simply state that the treatment of wells by permanganate of potassium was carried out, but add no opinion as to the efficacy of this treatment. The Sanitary Commissioner himself, however, as the result of great experience gives his own views in the following terms :—"It may be here stated that the use of permanganate of potassium, in the "disinfection of wells against cholera infection, has not resulted in any appreciable diminution in "the number of cases in epidemic times. During the late and other epidemics its efficacy in staying "the disease was not more appreciable than by adopting ordinary measures of precaution regarding "pollution and contamination by preventing general, or greatly limiting, access to the general supply. "The application, in fact, of permanganate of potassium to ordinary unprotected water-supplies, does "not, it may be definitely stated, much or materially diminish the risk of cholera infection in "epidemic times." As helping to throw light on the question of cholera mortality amongst the labourers recruited for employment in Assam, which has long engaged the earnest attention of the Government of that province, a remark made regarding the history of the disease in the Bilaspur district is worth quoting :—"The disease prevailed during the whole year. The epidemic of 1896 "did not cease, and sporadic cases kept cropping up among batches of the tea-garden coolie "emigrants."

5. The assembly of large numbers of people on the relief works, which appeared to favour outbreaks of cholera, might have been expected to have favoured the dissemination of small-pox. As a matter of fact, however, the mortality from small-pox was less than half that due to it in the preceding year. The number of deaths fell from 7,747 in 1896, and from a decennial mean of 5,536·8, to 3,641 in the year under report. It may be noted, in passing, that paragraph 93 of the Sanitary Commissioner's Report seems merely to be a repetition of the last line of figures in the table accompanying the preceding paragraph, and might have been omitted. The course of the disease according to monthly incidence was that usual in these provinces. Of the total number of persons who died from it, 888 were infants under one year of age, 1,428 children under 10 years, and the remaining 1,325 persons over 10 years. The number of persons vaccinated by the Provincial Vaccination Department has decreased year by year since 1894–95, when it was 399,879, until during the year under report it was only 306,673. It could scarcely have been otherwise, when it is considered that the number of children born decreased from 368,884 in 1894 to 254,973 in 1897. In addition, it is certain that during a year of so much distress and sickness, a larger proportion of the people than usual, and more especially of young children, must have been unfit to undergo vaccination owing to some form of illness. In view of the exceptional difficulties it had to contend with, it is, the Chief Commissioner thinks, "creditable to the Department that it should be able to "show so good an outturn of work." Of the total number of cases of vaccination, 18·79 per cent. were examined by Civil Surgeons, and of these 92·52 were found to be successful. The percentage of successful cases claimed by the vaccinators themselves was 96·73. In some districts the difference between the percentage of success as ascertained by the Civil Surgeons and that claimed by vaccinators seems to call for inquiry. Of the cases examined by the Civil Surgeon of Chindwara, only 55·88 per cent. were found to be successful, whilst the percentage of success claimed by the vaccinators was 90·39. Similarly in Mandla, whilst the Civil Surgeon found only 69·68 per cent. of the cases examined by him to be successful, the vaccinators recorded 99·20, or nearly cent. per cent. to be successful. In the Chandwara district "vaccination was performed with animal lymph." In the Mandla district "bovine lymph and lanoline paste were both used." Although the great majority of vaccine operations throughout the provinces were performed with animal lymph, humanized lymph as well was used in many of the districts.

6. *Fevers* carried off no fewer than 389,335 of the population. As usual, however, in this number are included many deaths from other diseases, and particularly deaths from acute dysentery and diarrhœa. A careful inquiry has led to the conclusion that the fever was of the ordinary malarial type, and that the suspicions entertained in some quarters that it was contagious were groundless. As in ordinary years, it was most prevalent and fatal in the autumn months, the ratio of mortality due to it having exceeded 5 *per mille* of population in each of the months of August, September, and October, and fallen to 2·77 in December. "It has been a matter of common observation in "former famine periods," writes the Sanitary Commissioner, "that fevers of a fatal type prevailed "during the autumn following; and this is accounted for by the fact that the fall of heavy monsoon "rain after prolonged drought, greatly favours the development of the natural phenomena and "conditions which promote a pernicious type of malarial fever which attacks rich and poor alike, but "especially carries off the debilitated by famine and privation." In 1869 the Chief Commissioner wrote :—"The exceptional mortality of the year began just when the famine ended, and when bad "and insufficient food had produced its full effect." In some districts inquiry showed that a large proportion of the deaths returned as having been caused by fever were really due to other diseases. In the Balaghat district, for example, "about 45 per cent. of the deaths investigated were actually "due to acute diarrhœa and dysentery, but returned as fever."

7. *Dysentery and Diarrhœa* in a year of so great privation were certain to be unusually prevalent and fatal. The death-rate from them was nearly four times greater than the mean of the decennium; and it is certain that, as already stated, many deaths were returned as having been caused by fever which were really due to dysentery or diarrhœa. The months of highest mortality from bowel complaints were likewise the months of highest fever mortality. In some districts the death-rate recorded was excessive. Whilst the provincial rate was only 8·53, that recorded in Murwara was 24·14, and in the Mandla district 23·12 per 1,000 of population.

8. *Sanitary Works.*—A detailed account of these is given in Section IX. of the Report. The most important of them were in connection with improvement of the water-supply. The new waterworks at Warda made good progress and were approaching completion. The supply for Jubbulpore was much improved; whilst a large number of wells in the other districts were cleaned out and repaired. Although sanitary works on a large scale could not be carried out during a year when all the available funds were required for the relief of distress, yet it is evident, from the account given by the Sanitary Commissioner, that many useful improvements of a simple and inexpensive nature were effected throughout the provinces.

9. The Village Sanitation Act (Act XIX of 1889) has been extended to 43 villages in the Central Provinces, but owing to the same causes which retarded sanitary improvement in towns, progress in these villages was necessarily impeded. The whole expenditure under the Act amounted only to Rs. 8,878. 7. 10. It speaks well for the efficiency of the sanitary arrangements at the many fairs held during the year, that in the case of none of them was there any outbreak of epidemic disease. The Sanitary Board met once during the year in each of the four divisions of the Central Provinces, and the minutes of the proceedings are printed as an *appendix* to the Sanitary Report. "The expenditure "on sanitary works during the year was very small. In some districts the work of sanitary "improvement was, on account of the general distress and want of funds, very much curtailed, "and in several districts was brought to a standstill by reason of the famine."

10. Briefly, the year 1897 was the most disastrous on record. Acute famine following a succession of bad harvests pressed severely on the people, and necessitated the giving of assistance on a vast scale by the Government. The numbers in receipt of relief had in the month of May attained a maximum of 691,890. Whilst the birth-rate decreased from a mean of 41·56 per thousand during the decennium 1881–90 to only 26·83 in the year under report, the death-rate rose from a mean annual rate of 33·76 in the five years 1891–95 to 69·34. The deaths exceeded the births by no fewer than 403,849. Cholera, fever, and bowel complaints carried off large numbers of those enfeebled by prolonged privation. Collections of people on the relief works seemed to favour outbreaks of cholera. In the autumn months malarial fevers were excessively destructive. Bowel complaints, due to insufficient and unsuitable food, were the causes of more than the 81,092 deaths with which they are credited. Inquiry in certain districts showed that many deaths due to these scourges of the famine-stricken were entered in the returns under the head of fever. Small-pox was not specially prevalent. Considering the great difficulties the Vaccination Department had to contend with, and the decrease in the birth-rate, the number of persons vaccinated was higher than might have been expected. A considerable amount of useful sanitary work was carried out; but the diversion of funds to the relief of distress, and the employment of all available officers in the management of relief operations, necessarily retarded sanitary progress.

9th June 1899.

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1897.

In the provincial review of the Sanitary Report, 1897 is described as having been most unhealthy and a season of extraordinary trial. This description is fully borne out by the vital statistics of the year. In a population of just over five millions the number of deaths exceeded the number of births by no fewer than 90,476. In some of the congested divisions of Bengal and the North-Western Provinces such a loss of population might have no very serious effect on their posterity; but in a new province like Assam, which above everything needs more people for its development, it could not fail sensibly to check its progress. Taking the meteorological records available for the three districts of Cachar, Goalpara, and Sibsagar as representing the climatic conditions of the province for the year, it appears that, in the first of these, the temperature was about the average and the rainfall 25·29 inches per cent. below it; in the second, the mean temperature was slightly, and the rainfall considerably, above the average; whilst in the third, the temperature was somewhat, and the rainfall considerably, above the average. In the first two of the three districts named the price of food was much, and in the last slightly, above the average for the five years 1892–96. Doubtless the dearness of food would have an unfavourable effect on the health of the population; but the meteorological features of the season as above described do not differ so materially from those ordinarily prevailing as to afford a sufficient explanation of the unusual unhealthiness of the year. On the contrary, it might have been expected that a decrease of the rainfall in Cachar from 140·91 to 115·62 inches would have been accompanied by a decrease in the prevalence of malarial diseases. So far, however, was this from having been the case, that "the fever death-rate was much more than double, and the "death-rate from bowel complaints was much greater than the average of the previous five years." In the other two districts the rainfall, as already stated, was considerably greater than ordinary, and

yet in the one fever mortality was only slightly greater, whilst in the other it was slightly less than the average. In other parts of India the lessened rainfall of the year, although disastrous to the crops and indirectly to the health of the people by causing scarcity or dearness of food, was yet attended by diminished prevalence of malarial diseases. In Assam, or at least in the districts for which meteorological records are given, diminished rainfall and increase of fever went together; whilst increased rainfall was accompanied by only a slight increase, or even by a decrease of fever. In addition to other influences affecting the health of the province, the Chief Commissioner considers that the disastrous earthquake which occurred in June may have been connected with the epidemic prevalence of cholera, especially during the last three months of the year:—"It appears to the Chief "Commissioner that it may be attributed to the floods (which were the direct result of the earthquake, "owing to the falling-in of the river banks and the raising of river beds), which, when they receded, "left, as excessive floods will do, the surface of the country saturated with malaria and the germs of "disease."

2. *Vital Statistics.*—The birth-rate recorded for the year was 32·59 per 1,000 of population, as compared with 33·69 for the preceding year, and with 31·39, the average for the five years 1892–96. This rate exceeds that recorded in the North-Western Provinces, Burma, Madras, and the Central Provinces. Yet, there can be no doubt that, owing to defective registration, it is understated. In the district of Goalpara, as the result of the great interest taken in registration by the District Superintendent of Police, a birth-rate of 45·12 was recorded; whilst in the rest of the Assam Valley, excluding Goalpara, the rate was only 27·05. In his review of the Sanitary Report, the Chief Commissioner observes:—"In the districts of Assam proper there has been no improvement in the registration by "unpaid *gaonburas*, and the checking of village registers by the police and by inspectors of vaccination "appears to have been generally perfunctory." The results of the checking of village registers are given at pages 12 and 13 of the Sanitary Commissioner's Report, and fully confirm the belief that the checking was carried out in a perfunctory manner. In the Sylhet, Darrang, Sibsagar, Lakhimpur, and Khasi and Jaintia Hills districts, not a single omission of a birth or a death was detected by the inspectors of vaccination, "although it is known that registration of vital occurrences is very "imperfectly carried out in all the districts."

3. The *death-rate* of the preceding year was described as the highest on record. It was then, however, only 36·33 per 1,000 of population. The death-rate for the year under review was 50·61. No doubt both years, as compared with preceding years, are to some extent indebted to improved registration for the increase; but, as compared with each other, the influence of improved registration on the records of the second of two consecutive years would probably be but slight. Such a conclusion would seem to receive support from the fact that, whilst the death-rate of 1897 was so greatly higher than the death-rate of 1896, the birth-rate of the former shows a decrease as compared with that of the latter. High although the death-rate of 50·61 is, it is certainly below the actual rate. A reference to page 12 of the Report leaves no room for doubt on this point. In the Cachar district 9,548 deaths were checked, with the result that 529 unreported deaths were discovered. So also in Sylhet and Goalpara districts, 2,277 deaths were discovered to have escaped registration in 3,928 villages in the former, and 725 in 706 villages in the latter district. Excepting in the Central Provinces, in which severe famine prevailed, and in which the death-rate reached 69·34 per thousand of population, in no other province of India was the rate for the year so high as in Assam.

4. *General History of the Chief Diseases.*—The number of deaths recorded under the head of each cause, except small-pox, shows an increase over the number for 1896. In the case of *cholera* the number is nearly double. During the preceding year cholera accounted for 17,042 deaths; and in the year under report for 33,240. As usual, the incidence of the disease varied greatly in different districts. In the two adjoining districts of Goalpara and Kamrup in the Brahmaputra Valley the cholera death-rate was excessive, reaching 10·35 in the former and 17·46 *per mille* of population in the latter. In the districts of Nowgong and Sylhet, the former in the Brahmaputra and the latter in the Surma Valley, the rates were respectively only 2·03 and 3·36. In the chief towns of the province the mortality varied within still wider limits. In Dubri the cholera death-rate was 58·86, and in Tezpur 62·08 per thousand of the population of these towns; whilst in Nowgong it was only 0·62, and in Dibrugarh 0·81. The only two towns in the province in which waterworks have yet been constructed show respectively death-rates of 9·42 and 1·04. The Sanitary Commissioner accounts for the enormous mortality in the towns of Tezpur, Dubri, and Silchar as follows:—"A large number of "cases of cholera occurred amongst coolies going up the Brahmaputra and Surma rivers in steamers "during the first quarter of the year, and 470 cholera deaths occurred at these places amongst coolies "who were landed suffering from the disease, 21 at Silchar, 216 at Dubri, and 233 at Tezpur. "Excluding these 470 deaths, the cholera death-rate in *sadar* towns was 5·20 per 1,000, somewhat "less than the rate in the province as a whole." The Surma and Brahmaputra Valleys are, the Sanitary Commissioner affirms, the endemic home of cholera; and deaths from the disease were, in accordance with ordinary experience, registered in every district during every month of the year. He thinks the probability is that the disease is usually conveyed through the water-supply. "It is "certainly the case that in these two valleys the water-supply is extremely liable to contamination." The Civil Surgeon of Kamrup, the district which shows the highest death-rate, gives it as his opinion that the excessive prevalence of this disease in his district was one of the results of the earthquake. It is shown, however, by the Sanitary Commissioner that cholera was very prevalent in Kamrup in May, the month preceding that in which the earthquake took place; and that during June there was not only no increase but a "sudden drop" in the prevalence of the disease. He admits, however, that "several local outbreaks, notably the one at Barpeta, were probably increased by the pollution "of the water-supply produced by the disturbances caused by the earthquake." In dealing with the cholera epidemic of the year, the Chief Commissioner considers that the Sanitary Report does not furnish adequate information regarding the epidemic which occurred among immigrant coolies on the river steamers during the first three months of the year. That the importation of the disease by these coolies had a very decided effect on the death-rate of the towns at which they were landed has already been shown. In the 8th paragraph of the review by the Chief Commissioner of the Sanitary

Report, the question of the introduction of cholera by the immigrant tea-garden coolies is thoroughly dealt with. If the Sanitary Commissioner is correct in concluding that the disease is endemic in Assam, its introduction by immigrant coolies would not be needful to account for the lighting up of epidemic outbreaks; but the importation of an unprecedented number of coolies, many of them sickly and unfit to undertake the journey from their homes in the famine-stricken districts in which they were recruited, must have had no little effect in disseminating cholera along the lines of their conveyance through the province. The figures given show that amongst these immigration coolies 371 died of cholera on the river steamers and 750 at the depôts after they landed. This mortality need cause no surprise when it is known that "it is the practice both at Goalundo and Jatrapur to "ship coolies with all despatch, and no regard has hitherto been paid to the all-important matter of "allowing only those to embark who are not tainted by association with those who are sick or have "died from cholera." It is, however, satisfactory to learn that the Assam Government has adopted measures which are calculated to prevent a recurrence of the terrible cholera mortality amongst the coolie immigrants which has been so deplorable a feature in the sanitary history of the year.

5. The mortality from *small-pox* was slightly less than it was in the previous year, but nearly double the average of the five-year period 1891–95. The death-rate from this disease was 1·08 in the year under review, and 1·09 in 1896; whilst the average for the previous five years did not exceed 0·57. In the Sibsagar district small-pox prevailed in severe epidemic form, and was productive of a death-rate of 5·10 per thousand of population. A reference to the diagram in the Annual Vaccination Report for the year 1897–98 shows that, contrary to what might have been expected, the districts with the largest proportion of their population protected by vaccination suffered most during the last seven years. During 1897 small-pox deaths were fewest in Cachar, the district which, with one exception, is least protected by vaccination. The Sanitary Commissioner's explanation of the paradox is probably the correct one. In all districts, even in those in which vaccination is most complete, a considerable proportion of the inhabitants annually escape vaccination. In the absence of small-pox, this unprotected residuum goes on accumulating year by year until small-pox contagion is somehow introduced, when an epidemic follows, of a severity proportionate to the length of time the unprotected residuum has been accumulating. Districts with difficult communications and infrequent intercourse with outside might be expected to escape small-pox infection for more prolonged periods than other districts with greater facilities and freedom of communication. In the former, the unprotected residuum having had a longer time to accumulate, an outbreak of small-pox when it did occur, even in the event of the district showing a higher proportion of population annually vaccinated, might nevertheless be more severe than in the latter. Vaccination made satisfactory progress during 1897–98. There were 2,074 more primary and 3,159 more re-vaccinations than during the preceding year. The recorded percentage of successful cases in primary vaccination was, according to Statement No. I., 98·84, and in re-vaccination 92·05. Both percentages are high, but especially the percentage in re-vaccination. It would be useful to learn what was regarded as "successful" re-vaccination. Some vaccinators are only too ready to record any operation which is followed by the least visible signs of local irritation as entitling it to be recorded in their returns as "successful." No fewer than 150,005 cases of vaccination out of a total of 272,760, excluding 11,154 vaccinations by tea-garden agencies, were seen by inspectors of vaccination, and of these a percentage of 98·14 were found to have been successful. If, however, the quality of the work of these officials may be gauged by its quality in the examination of birth and death registers, it cannot be accepted with complete confidence. We have already seen that in several districts in which registration of vital statistics is known to be very imperfect, the inspectors of vaccination, as the result of their investigations, "found that not a single "birth or death had been omitted" from the registers. When we read that 3,277 arm-to-arm vaccinations were performed and that every one of them were successful, and see in the return on page 4 of the Vaccination Report that cent. per cent. of the cases inspected in the Cachar and Kamrup districts, and 99·76 per cent. out of 24,854 inspected in Goalpara, were found to have been successful, we think, in the words of the Chief Commissioner, there is "need for closer scrutiny of vaccination "results on the part of Civil Surgeons." A satisfactory feature of the season's work is the increase in the number of vaccinations of children under one year of age; this increase was from 44,472 in the previous season to 55,574 in the season under review.

6. The mortality from *fevers* during the past year was the greatest hitherto recorded in Assam. The total number of deaths, including those from *kála-azár*, was 144,307, as compared with 101,347 in 1896, and an average of only 84,774 in the five years 1891–95. In all of the districts, except three, the fever death-rate exceeded 30 *per mille* of population, and in one district was 41·77. The death-rate in Assam from fever alone was higher than the recorded death-rate from all causes in either Madras or Burma. After completion of his investigation into the nature of *kála-azár*, Dr. Leonard Rogers has submitted a report which conclusively shows that a previous investigator, Dr. Giles, was mistaken in regarding *kála-azár* and *anchylostomiasis* as one and the same disease. Dr. Rogers considers *kála-azár* to be an intense form of malarial fever closely resembling, if not absolutely identical with, the so-called "Burdwan Fever," which, during the sixties and early seventies, ravaged the Burdwan Division of Bengal. Subsequently to its abatement in Burdwan in 1874, this "Burdwan "Fever" spread to other districts; and Dr. Rogers shows grounds for believing that it crossed the Brahmaputra from the Rungpore district into Assam. From the accounts given of it by medical officers it seems to have differed in no essential feature from the Assam *kála-azár*. It was acknowledged to be malarial in its nature and to be communicable or contagious. Dr. Rogers is convinced that in these respects the "Burdwan Fever" and the *kála-azár* of Assam are identical. He shows that in its early stage it is impossible to differentiate *kála-azár* from ordinary malarial fever. Although the returns show the deaths from these two forms of fever separately, it is certain that many must be recorded as due to *kála-azár* which should have been recorded under the head of ordinary malarial fever, and *vice versâ*. *Kála-azár* is shown to have been slowly but surely spreading up the Assam Valley for the last 20 years, and Dr. Rogers, taking into account its nature and past history, sees no reason for hope that it will spontaneously subside until it reaches the hills that form the easternmost boundary of the valley. Whether the measures proposed by him with a view to arresting its progress will prove successful remains to be seen. The difficulty will be to carry out

these measures in their integrity. The Chief Commissioner considers that the scheme for the sale of quinine is making satisfactory progress. During the year 2,181 packets, each containing 102 five-grain doses, were sold, as compared with only 1,059 packets in 1896.

7. *Sanitary Works.*—Regarding urban sanitation the Chief Commissioner writes :—" No important " sanitary improvements could be carried out, as most municipalities were compelled to devote all " their available resources to the repair of damages caused by the earthquake, and the incomes of " many were curtailed by the remission of taxation which that calamity necessitated." Regarding the proposal to introduce into Assam a Village Sanitation Regulation on the lines of the North-Western Provinces Sanitary Act II of 1895, the Chief Commissioner says that, so far as he can judge, " the only practical result of the enforcement of such a regulation would be the harassment of remote " villages inhabited by an ignorant peasantry, and he is not prepared to take any steps for furthering " its enactment."

8. Briefly told, the year 1897 in Assam was, from a health point of view, the most disastrous on record. Accompanying a diminished birth-rate, the death-rate was unprecedently high. The mortality from all the chief causes of death, excepting small-pox, was excessive. Cholera caused nearly twice as many deaths as in the preceding year. The question of its prevalence amongst the coolies imported from other provinces into Assam has been thoroughly dealt with by the Government of the province, and measures adopted which, it is believed, will have the effect of reducing in future the mortality from this disease. Small-pox mortality was nearly the same as during the preceding year. Vaccination makes satisfactory progress, especially as regards the number of infants vaccinated. Dr. Rogers records the results of his investigation into the nature of *kála-azár* in a lucid and interesting report. He is satisfied that this disease is an intense and contagious form of malarial fever, closely allied to, if not identical with, the destructive " Burdwan Fever " of the sixties and seventies. Whether the measures he proposes with a view to stay its progress will prove successful remains to be seen. The progress of sanitary works has been temporarily arrested by the damage and loss arising from the destructive earthquake of June. Wisely, it appears to us, the Chief Commissioner declines at present to further the introduction of a Village Sanitary Regulation on the lines of the North-Western Provinces Sanitary Act II of 1895, as being likely to lead to the harassment of the ignorant villagers without compensating benefit to health.

9th June 1899.

No. 8.

Memorandum by the Army Sanitary Commission on the Rajputana Sanitary, Vaccination, Dispensary, and Jail Report for 1897.

Approximately correct returns are still available only for the tract of country known as Ajmere-Merwara, or the Ajmere Division. The population of this division, numbering according to last census 542,358, is less than half the population of many a single district of an Indian Province. The population of the 21 Native States dealt with in the Report is not known for certain, but is " computed " to be 11,688,720. Until reliable statistics are available for this vast country and numerous population, useful deductions regarding the incidence of disease and the influence of sanitary measures on the public health cannot be drawn. In 17 of the States some attempt is made to register births and deaths, but hitherto with only indifferent success. This is evident when it is seen that, for these as a whole, the average birth-rate recorded was only 13·90 and the average death-rate only 15·12 per thousand of population. In one of the States a ratio of 2·81 births and of 2·79 deaths is recorded. Obviously, it would serve no useful purpose to treat such figures seriously.

2. In spite of the high prices which prevailed in Ajmere-Merwara, the year under report was not an unhealthy one. The recorded rainfall, though less than that of 1896, was above the average of the preceding six years. Whilst the birth-rate increased from 32·77 in the previous year to 33·69, the death-rate at the same time fell from 28·25 to 24·68 per thousand of population. These figures appear to show that even in the Ajmere Division, with its small population of rather over half a million, there is still room for improvement in the registration of vital statistics. In a year of high prices and immediately following one of scarcity, a death-rate of 24·68 *per mille* of population probably represents but a part of the whole mortality. *Fevers* were credited with 81·20 per cent. of the total number of deaths from all causes. *Cholera* and *small-pox* between them caused only 177 deaths. The mortality from small-pox was little more than a twenty-fourth of what occurred in the preceding year. " More efficient vaccination is being done throughout Ajmere-Merwara," writes the Administrative Medical Officer, " and the supervision has been improved, so it is hoped the mortality " from small-pox will continue to be much lower than it has hitherto been in this Division."

3. The number of primary vaccinations during the year 1897–98 increased from 15,764 to 16,272 successful cases ; and the percentage of success from 96·82 to 98·74. On the other hand, successful re-vaccination cases decreased from 242 to 46. In the Native States there was a large increase in the number both of primary and re-vaccination cases. As in previous years, the recorded percentage of successful cases in some of the Native States is surprising. In six of these States upwards of 99 per cent. of the primary cases of re-vaccination are recorded to have been successful, and in the State of Ulwar the percentage was 99·90. Verification of the returns by Superintendents and Native Superintendents support these remarkable records. The Assistant Superintendent in the City of Jeypore tested 1,224 cases without discovering a single failure amongst them. It is not often that in

provinces under British Administration such ratios of success are recorded; and when they do appear, inquiry generally leads to the conclusion that they are obtained by the exclusion from their registers by the vaccinators of their unsuccessful operations. In his last Annual Report the Administrative Medical Officer directed the attention of Residency and Agency Surgeons "to the "necessity for the more thorough supervision of vaccination," and repeats his injunctions in his report for this year. If a recurrence of the small-pox epidemic, which carried off 3,821 persons, equal to 7·03 per thousand of the population, during the preceding year in the Ajmere Division, is to be avoided, further efforts will have to be made to protect the infant population. Of the 18,271 children born during the calendar year, 2,025 are stated to have died, leaving available for vaccination 16,246. Of these latter, 10,996 were successfully vaccinated; whilst 5,250 remained unprotected. In other words, nearly one of every three children under one year of age available for vaccination remained unvaccinated.

4. During the previous year 16 deaths from *plague*, or suspected plague, were reported from Rajputana. All of these were imported cases. It was not until November of the year under report that a case occurred amongst the indigenous population. In that year "a wealthy Seth found his "way into the village of Tewri in Sirohi State and died there of plague; his funeral ceremony was "well attended, and it was very soon followed by an outbreak of indigenous plague in this and three "other villages adjacent." The mode of introduction of the disease is suggestive of one of the means by which the resistance offered to the admission of infected persons into a district is overcome in India. A poor man from an infected place would probably have been promptly stopped; but the wealthy Seth "successfully evaded detection." The villages in which the disease appeared were evacuated and disinfected, with the result that "the outbreak seemed to stop after this." Unfortunately, the coldness of the weather seems to have driven the people back to their villages before the houses had become safe for re-occupation, and further cases occurred as a consequence. In the Himalayas, when houses in a village are infected with plague, it is usual to burn them down. This drastic treatment effectually puts an end to the risk which might arise from premature re-occupation of infected houses. "The disease was of the pneumonic type and very rapidly fatal at first, but "afterwards glandular swellings were common and some recoveries took place." The Administrative Medical Officer believes that there is nothing more destructive to the plague germ than the heat and light of the sun and free ventilation. This seems to be the experience of others who have been engaged in dealing with plague. Surgeon-Captain Grant's experience on this point should be recorded. He says:—"At first it was the custom to disinfect with perchloride of mercury solution "the clothes and bedding of contacts removed to the segregation camp. A few cases (of course in "the incubation stage at the time of the disinfection) having appeared shortly after the operation, so "much objection was raised, that as the discontent threatened to become universal it had to be given "up for a time. Free exposure of clothes, &c., to the sun's rays had to be trusted to, and this seemed "to answer the purpose equally well." Although the outbreak was alarming, it cannot be said to have been very destructive to life. "In all, there were during the course of the epidemic 166 "indigenous cases and 143 deaths, of which the larger proportion occurred among members of the "baniya caste."

5. The figures given of the numbers of indoor and outdoor patients relieved in the hospitals and dispensaries bear testimony to the popularity and usefulness of those institutions. Of both classes of patients nearly a million were treated. The combined number of surgical operations performed in Ajmere-Merwara and the Native States was 62,004. By far the greater number of patients were treated for diseases of malarial origin. The endeavour to bring quinine within reach of the people remote from hospitals and dispensaries by arranging for its sale at post offices, continues to be attended with considerable success. The number of doses of the drug sold increased from 36,618 in the preceding year to 46,920 in the year under report. It is noted that leprosy, contrary to the fears entertained by some, would seem to be decreasing in Rajputana. "There were 650 cases of leprosy "treated during the year as against 842 in the previous year, a decrease that is the more satisfactory "in view of the increased attendance at dispensaries and hospitals."

6. The health of the Ajmere jail was good. The death-rate therein fell from 13·26 *per mille* of its population in the previous year to 6·84 in the year under report. In the Native State's jails as a whole, also, the death-rate decreased from a ratio per thousand of their inmates of 28·17 to 23·58; but in some of them the mortality was excessive. In previous memoranda we have commented on the unhealthiness of the jail at Banswara. Last year the death-rate in this jail was as high as 131·60 per thousand of strength: in the year under report it has further increased to 174·41. Such figures speak for themselves. In one other jail, that of Dholpore, the prisoners have been more than decimated, and in a third the death-rate was 88·17 per thousand of strength. Regarding jail management of the Rajputana States generally, it is stated that steady progress is being made, and that most of the jails are in good order; but "a few of the old jails are, however, still very defective in drainage, "construction, and management, and in some States there is still much overcrowding of prisoners, "and these defects require early remedy." Consignment to a jail such as that of Banswara means more than imprisonment. The death-rate amongst the free population of the State is recorded to be 18·10 per thousand, and in the jail it is 174·41; so that, in addition to imprisonment the risk to life which a convict undergoes is increased ninefold.

7. It is proposed to appoint an Assistant Surgeon as Health Officer of Ajmere-Merwara. In superintending the collection of vital statistics, vaccination, and sanitation throughout the two districts, he could no doubt be very usefully employed. As regards sanitation in the Native States, the first requirements are the correct enumeration of the population, and the institution of an effective system of registration of births and deaths. Until the population of a State is known, and a record kept of the number of births and deaths occurring in it, neither its sanitary needs nor the effects of sanitary improvements carried out in it can be ascertained with an approach to certainty. "Endeavours "are being made to have special registration departments formed," the Agent to the Governor-General writes. It is to be hoped that these endeavours may be persisted in until they are successful.

8. Briefly, the year, in spite of high prices of food grains, was not unhealthy. Whilst the birth-rate increased, the death-rate diminished in the Ajmere Division—the comparatively small portion of Rajputana for which reliable vital statistics are available. This division has a population of only somewhat over half a million; whilst the States, for which reliable vital statistics are not yet available, have a population of upwards of eleven millions. Cholera was in abeyance in Ajmere-Merwara, accounting for only 18 deaths. Following the severe small-pox epidemic of the preceding year, the deaths from that disease numbered only 158. There was some increase in the numbers vaccinated in the Ajmere Division; but the returns show that about one of every three children under one year of age available for vaccination remains unvaccinated. The accumulation of this unprotected residuum renders the recurrence of another epidemic of small-pox at no distant date more than a probability. As in former years, the percentage of successful cases of vaccination obtained in some of the Native States was remarkable. Humanized vaccine lymph is still in general use in Rajputana; and if the recorded percentage of successful cases is to be accepted, no substitute for it has yet been found which excels it in efficiency. Plague succeeded in effecting a lodgment amongst the indigenous population of Rajputana during November; but the mortality caused thereby was not very great. The evacuation of the infected villages, here as elsewhere, proved the most effectual measure for staying the progress of the disease. The number, popularity, and usefulness of the hospitals and dispensaries continue to increase from year to year. Jail improvement is receiving attention; but there are still some old and defective prisons in which the mortality is lamentable. In the Banswara jail the death-rate in 1896 was 131·60; and in the year under report rose to 174·41 per thousand of its inmates. It is to be hoped that in the near future it may be found possible to obtain a correct census of the population of the several States of Rajputana, and to introduce into them an efficient system of registration of births and deaths. The record of vital statistics is a preliminary and essential step if sanitation is to be conducted on intelligent principles.

10th August 1899.

No. 9.

Memorandum by the Army Sanitary Commission on the Medical and Sanitary Report of Coorg for 1897.

The year was an unusually unhealthy one. The mortality from the chief diseases, excluding small-pox, was the highest hitherto recorded. Fever mortality was more than twice as great as in the preceding year, and exactly twice as great as the average of the five-year period 1892–96. Bowel complaints were also unusually fatal. The rainfall recorded was 134·04 inches, as compared with 157·6 in the previous year, and with a quinquennial average of 119·19 for 1892–96. The mean temperature of the year exceeded that of 1896 by only two decimals, and was less than that of 1894. Accompanying these climatic conditions, the price of the staple food of the people was higher than that which prevailed in the preceding year, and than the average for the five years 1892–96. Although the price of rice was exactly the same as the average price for the quinquennial period 1892–96, and only a fraction higher than in 1896, the rise in the price of *ragi*, the staple food of the poor, was serious: the average for the quinquennium 1892–96 was 26·7 seers of *ragi* per rupee, and in the year under report only 19·5 seers. "The high price of food grains began to be felt during the "monsoon months, a time when the people required good nourishment." To this the Civil Surgeon adds:—"Although there was no famine in the province itself, the effects of it in other places "influenced the high mortality of Coorg by the influx of people coming to seek employment." But, beyond such influences as high prices and meteorological conditions, there must have been an additional something to account for the prevalence of fatality of the fever, which caused 41·50 of a total death-rate of 50·02 per thousand of population. There is no evidence to show that this was other than an intense form of the ordinary malarial fever annually prevailing. It "attacked both "rich and poor, and at one time threatened to cause serious hindrance to Government work, owing "to the number of officials who were down with it. All alike, Europeans and Natives, suffered from "it, but its symptoms were those of a malarial fever and not of famine fever." Much remains to be discovered regarding the causes which give rise to those wide-spread and fatal epidemics of malarial fever which periodically visit the different provinces of India. In the present case, neither the climatic features of the year nor the high prices of food were of so exceptional a character as, of themselves, to afford a sufficient explanation.

2. *Vital Statistics.*—Last year there was a slight excess of births over deaths; but during the year under report the number of births was less than half the number of deaths. Whilst the births decreased from 4,606 in the previous year to 3,503 in the year under report, the deaths at the same time increased from 4,574 to 8,658. The unhealthiness of the year no doubt to some extent affected the birth-rate, although this would chiefly be influenced by the health conditions of the previous year. Registration is still acknowledged to be defective, but it is probably improving rather than retrograding, and would not, therefore, account for a falling-off in the number of children born in the year 1897 as compared with the number born in 1896. The recorded ratio of births per thousand of population was 20·24. It has been more than once explained that, apart from defective registration and unhealthy seasons, the proportion of the sexes constituting the population must necessarily exercise a marked influence on the vital statistics of the province. Of a population of 173,055 in Coorg, more than 50,000 are immigrant coolies who come annually, mostly without their wives and families, to work on coffee estates. These coolies, constituting more than a fourth of the population, necessarily lower the birth-rate calculated on the census figures, and, as they succumb in large

numbers to the climate of Coorg, they at the same time raise the death-rate. In spite of the efforts made by the Administration to protect these immigrants from the injurious effects of the climate, they continue still abnormally to swell the death-rate of the province. Indeed, it has been definitely shown that the abnormal features of the vital statistics of Coorg are mainly due to the presence in its population of the immigrant coolie element. At the taking of the census of 1891 the Superintendent of Census operations showed that, although there was a decrease in the total population of the province since the taking of the previous census, this decrease was confined entirely to the immigrant coolie element; and that there was not only no decrease, but an increase of 16·12 per cent. of the indigenous portion of the population since 1881. During this intercensus period the immigrant population showed a decrease of 29·28 per cent. That defective registration, however, plays its part in the production of some of the peculiarities in the ratios of births and deaths seems more than probable. An examination of the figures in Annual Form I. shows remarkable and unexplained differences, especially in the birth-rates of the five districts composing the province. In the Mercara Taluk the ratio is only 16·59, and in the Yedenalknad Taluk 15·36 *per mille* of population; whilst in the Nanjarajpatna Taluk it is 26·12 *per mille*. It might be useful if, as in Burma and other provinces, the Civil Surgeon of Coorg submitted to the Commission a quarterly review of the returns of births and deaths of the several registration circles. In this he might invite attention to those circles in which the figures led him to suspect defective registration, and ask for an inquiry into the cause of the deviation of the figures from normal.

3. *Chief Diseases.*—Regarding *cholera* and *small-pox* no special remarks seem to be called for The former of these diseases is credited with 106, and the latter with 59 deaths. Both were more fatal than during the previous year; but in the case of small-pox the ratio of deaths per thousand of population was greatly less than the mean for the previous five years. Taking into account the unhealthiness of the year, vaccination made satisfactory progress. There were 10,977 people vaccinated, including dispensary vaccination and re-vaccination. There would have been even a larger number of vaccinations performed had not so many been rendered unfit to be operated on owing to weakness following the fever, which caused so much sickness and so high a rate of mortality among children. Of infants under one year of age only 907 were successfully vaccinated, as compared with 1,289; and of children under six years, 4,059, as compared with 4,113 in the preceding year. Both in primary vaccination and in re-vaccination the percentage of successful cases was higher than in the previous year, having been in the case of primary vaccination 95·21, and of re-vaccination 85·04, according to paragraph 3 of the Vaccination Report. Calf lymph only was used throughout. Turning to page 14 of the Appendix, Statement No. I. gives the percentage of successful cases of re-vaccination as 89·25, excluding dispensary vaccination cases. This is suspiciously high and would seem to suggest the need for inquiry. Statement No. V., page 17 of the Appendix, shows that the Civil Surgeon tested 170 cases of vaccination and found a percentage of only 90·00 successful; whilst Native Superintendents, or other inspecting officers, tested 3,505 cases and found a percentage of 98·94 successful, as against a percentage of 93·82 recorded by the vaccinators. It is not clear, however, whether in this statement the percentage is calculated on primary cases only, or on mixed primary and re-vaccination cases. Probably the latter of these suppositions is the correct one, as the percentage of success in primary cases shown in Statement No. I. is 95·80, and this is presumably the percentage calculated on the returns submitted by the vaccinators. "With regard "to the total population, 59·51 *per mille* were protected by vaccination, as compared with 56·72 in "the previous year, showing an increase of 2·79 *per mille*." Seeing that the recorded birth-rate was only 20·4, a vaccinated ratio of 59·51 per thousand would, taken by itself, seem to indicate that the population of Coorg was exceptionally well protected against small-pox. The practical test afforded by small-pox mortality does not, however, support such a conclusion. The average small-pox death rate for the fifteen years, beginning with 1882–83 and ending with the year under report, was 1·17 per thousand of population, and in 1892–93 the rate was as high as 5·27.

4. *Fever* was excessively prevalent and fatal. Of the total number of 8,658 deaths, no fewer than 7,182 were due to this cause alone; whilst 538 more were due to dysentery and diarrhœa. It would be useful if a return could be prepared giving the number of deaths amongst the immigrant coolies separately from the deaths amongst the indigenous population of the province. It is gathered from the account given of these coolies that they succumb in great numbers to the climate of Coorg. There are also some figures available which tend to confirm this conclusion. "In Mercara town there were 301 deaths; of these, 166 occurred in the hospital, 81 of which "were known to have occurred among coolies from Mysore, Malabar, South Canara, &c." Also in Virajendrapet "out of 519 deaths, 280 occurred in hospital, and of the latter no less than 238 were "known to have been coolies from Malabar, &c., on their way to or from coffee estates." From such statements it would appear that the high rate of mortality for the province was largely due to the greater liability to sickness and death of the 50,000 immigrant coolies annually coming to work on the coffee estates. Consequently, the measures most likely to be effectual in lessening this mortality would be such as would tend to remove the causes of sickness and mortality among these coolies. Already three shelters have been erected on the *ghâts*, and a fourth is being built for the use of the coolies entering and leaving the province. These, the Commissioner states, proved most useful last rains; but the President of the Sanitary Board is doubtless right in concluding that "without food or clothing shelters alone would not be sufficient to check the mortality now "brought to notice." We agree with the Civil Surgeon when he says that "although the shelters "were good so far as they went, they did not go to the root of the evil." He recommended an examination of coolies in the low country as to their fitness to come to Coorg, and that labour contractors should be allowed only to bring up coolies passed as medically fit; he further suggested that both maistries and labour contractors should be held responsible for the health of their coolies. Some such measures will have to be adopted if the lamentable mortality annually occurring amongst this class of labourers is to be checked. Not unnaturally, the Civil Surgeon's proposal was not favourably received by the representative of the planters' interests. The latter feared that a labour law, or a medical examination might interfere with the supply of labour; but when the people of the countries supplying the coolies fully realise the dangers to life and

health which emigrants to Coorg have to encounter, their unwillingness to meet these dangers may come by and by to render them disinclined to go there, and in this way more injuriously affect the labour supply than a medical examination or a Labour Act. Whatever their effect on coolie recruitment, effectual measures will have to be taken with the object of protecting the coolies, as far as may be found practicable, from the influences which have caused in the past, and are still causing, the excessive mortality annually occurring among them. The high death-rate, from dysentery and diarrhœa are suggestive of an insufficient or unsuitable dietary. The healthy condition of the prisoners in jail, during the months when the free population were dying in hundreds of fever and bowel complaints, goes to show that climate alone will not account for the fatality of these diseases. "During the most unhealthy period among the general population of "Mercara, the health of the prisoners was exceptionally good, and there was not a single admission "into hospital from the 20th July to the 30th September." It must be noted, however, that the average strength of the jail population was only 79·32, a number insufficient to form a basis for safe deductions. During the year the sale of quinine is said to have been successful.

5. Of the system of Village Sanitary Inspection Books prescribed by the Government of India, the Chief Commissioner remarks that it seems to have been a failure in Coorg.

6. Briefly, the year was very unhealthy and the mortality excessive. Climatic conditions were not of a specially exceptional character, although the rainfall was above the average for the preceding five-year period. The price of *ragi*, the staple grain used by the poor, rose from an average of 26·7 seers per rupee in the preceding five years, to 19·5 seers in the year under report. This doubtless unfavourably affected the public health. The number of births was less than half the number of deaths. Cholera and small-pox were between them accountable for 165 deaths, a number which looks insignificant by the side of 7,182 caused by fever and 583 by dysentery and diarrhœa. These latter diseases were unusually destructive of life. The 50,000 immigrant coolies annually entering Coorg in quest of employment on the coffee estates, suffered out of all proportion as compared with the indigenous population of the province. Indeed, the sanitary problem in Coorg in most urgent need of solution is how to lessen the mortality among the immigrant coolies, who constitute over a fourth of the entire population of the province. Something has been done to provide them with shelter on their way into and out of the province annually; but this does not reach the root of the evil, and if the lamentable loss of life yearly occurring amongst them is to be checked, measures of a more radical and far-reaching nature will have to be adopted.

9th June 1899.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1897.

The first 13 pages of the volume are taken up with the Report of the Sanitary Board for 1897 and its Appendix. Besides scrutinizing the plans and estimates of 185 sanitary works of an estimated value of nearly twelve lakhs of rupees, the Board issued to local bodies carefully worded circulars with instructions to help them in preparing plans and estimates of sanitary works. With type designs already in their possession, and this code of instructions to guide them, local bodies should now be in a position to submit their projects in a form capable of being dealt with by the Board. Hitherto, much trouble and delay have been occasioned owing to the defective state in which plans and estimates have been sent up to the Board. The question of a bacteriologist for the Presidency has been under the Board's consideration. The opinion of the Board is in favour of such an appointment; and it is stated that the Government, having arrived at the conclusion that there was a large scope for a bacteriologist in the Presidency, "advised the Government of India accordingly."

2. Famine, owing to crop failure following deficient and unreasonable rainfall in 1896, continued until October of the year under report. At the time of greatest pressure the area declared to be affected covered upwards of twenty-six thousand square miles, with a population of more than five and a half millions. The year's rainfall was considerably above that of the previous year, as well as that of the ten years ending 1894. The fall during the south-west monsoon was 9·04 inches above, and the fall during the north-east monsoon 6·98 inches below, the average. The prices of food grains were greatly higher than in the previous year, and than the average for the ten years ending 1894. For the whole Presidency the normal price of staple food grains was exceeded by 62·1 per cent.; but as the Sanitary Commissioner observes, average rates for districts give but a rough idea of the extent to which high prices prevailed in certain parts. In one locality he found that *cholum*, or *jawari*, was 251 per cent. above normal, and adds :—"This, as it "happened, was not only the price of the staple grain, but of the only grain available. As giving "some idea, beyond the quoting of these percentages of the range of high prices, I may state that, in "certain months and localities in the Ceded Districts, the price of the staple grain was the same as in "the great famine of 1877 and 1878." The effects of these conditions on the health of the Province as a whole, were not so serious, when judged by their influence on the birth and death rates, as might have been anticipated. It is only by dealing separately with the statistics of the districts which suffered most severely, that the effects of famine on fecundity and mortality are fully brought into view.

3. *Vital Statistics.*—According to the last census, the population of the Presidency numbered 35,641,828, but the population for which vital statistics are recorded numbers only 32,638,243, including Europeans and Eurasians. The birth-rate recorded for the year, excluding Europeans and Eurasians, was 28·7, and the death-rate 25·4 for town and rural circles combined, as compared with 29·9 and 20·6 in the preceding year. Although the rates given are doubtless, owing to defective registration, much understated for both years, and their comparison with the rates for other provinces in which registration is less defective might be misleading, they nevertheless give useful information when compared with each other. The Sanitary Commissioner says: "Registration results are much "vitiated in this Presidency in areas under Zamindars, in consequence of the services of the village "officials responsible for the statistics not being under the full control of the Revenue officers." This explains the first of the measures which the Madras Government last year decided to adopt for the improvement of registration, "by placing the village establishments in the zamindari tracts under "adequate control." A comparison of the results obtained in rural areas with those in municipalities shows that, in the latter, registration is carried out with far greater thoroughness than in the former. Whilst in rural areas a birth-rate of 28·8 per mille is recorded, the rate in municipalities is 34·4; and whilst in rural areas a death-rate of 24·4 is recorded, this in municipalities was 33·3. In paragraph 17 is given a list of the municipal towns in which penalties were inflicted for neglect of registration of vital statistics. From this it appears that in 59 municipalities penalties were inflicted for the omission to register 764 births and 666 deaths. Persistent scrutiny of the registers, and the infliction of a penalty when omission of entries is discovered, rarely fail to bring about improvement. The diagrams inserted between pages 34 and 35 show very clearly the effect of the famine on the birth and death rates. Although the Province generally suffered from high prices, famine was declared to exist in seven districts only. The diagram giving the death-rates shows that, with a single exception, all the registration circles returning the highest rates belonged to famine-stricken districts. The second highest series of death-rates also includes registration circles belonging to all the famine districts except Ganjam; and Ganjam does not contribute a circle to this series, because all of its circles, with a single exception, belong to the group recording the highest rates. The effect of famine in lowering the birth-rate is not so marked as in raising the death-rate. Taking the two famine-stricken districts of the Northern Circars as exhibiting most strikingly the effects of the famine on the vital statistics of their population, it is seen that, whilst in Ganjam the birth-rate only fell from a ratio of 26·6 per 1,000 in the preceding year to 23·9 in the year under report, its death-rate rose from 20·6 in the former year to 50·1 in the latter; and that whilst in Vizianagram the birth-rate fell from 31·7 to 28·3, the death-rate at the same time rose from 18·5 to 31·6. These figures demonstrate with sufficient clearness the influence of famine on a population, by checking fecundity and increasing mortality. An additional effect of famine is the stimulus it gives to emigration. Dr. King writes: "There was a net decrease of the "population by 92,118, on account of emigration from the ports of the Presidency. Of the total "number of 275,109 emigrants, 43,518 departed from the ports of Ganjam, Vizianagram, and Godavari. 'From these ports the emigration amounted to 1,996 above that for the previous year." But for the compensating effect of the unusual dryness, following the early cessation of the rains in the preceding year, in diminishing the prevalence and fatality of diseases of a malarious nature, there can be little doubt that the mortality consequent on the stress of famine and high prices would have been much greater. The death-rates recorded for the province in all of the months up to June, except January, were low, not reaching to 2 per mille of population.

4. *Chief Diseases.*—The deaths from *cholera* reached the enormous total of 143,445 against 47,847 in the previous year, or 4·4 against 1·5 per mille of population. This was for the Province as a whole; but some of the districts taken by themselves suffered far more severely. For example, Ganjam records no fewer than 15,533 deaths from this cause, or a ratio of 12·54 per thousand of its population. The disease prevailed in the Province throughout the entire year, the first death having been reported on the 1st of January and the last on the 31st of December. Town circles suffered more severely than rural circles, the ratio of cholera deaths in the former having been 5·0 as compared with 4·3 in the latter. In some of the municipalities the death-rate was excessive. In Cannanore it was 28·5, in Parlakimedi 23·6, and in Calicut 23·1 per thousand of their populations. Referring to Statement No. XI. of the Appendix, we find noted against Cannanore that the "*drainage* of old town is "defective. The existing cesspools in old town are rarely cleaned. *Water-supply.*—The wells in the "old town are shallow, and are either unprotected or hardly protected. They are near latrines, drains, "or burial grounds." Against Parlakimedi it is recorded:—"*Drainage.*—Only rough stone drains exist "for carriage of storm water. Sewage water from houses soaks into the ground for most part. One "more sewage cart is required. *Water-supply.*—The tanks are subject to gross pollution, fœcal "matter of all sorts being washed into them. Surroundings of private wells are bad. The wells are "constructed with earthen rings which admit of percolation of spilt water." Against Calicut, we read that of drainage there is no regular system, and that, as regards the water-supply, many of the wells in use need protection against contamination. The sanitary defects described are perhaps not more serious than those existing in the majority of the other municipal towns; but they are of such a nature and gravity that their removal would assuredly help to fortify these towns against the recurrence of cholera epidemics so destructive as those by which they were visited in the year under report. Regarding the disinfection of water-supplies, the Sanitary Commissioner states that this "is "freely practised," by permanganate of potash when the supplies to be dealt with are small, and by lime and alum when the supplies are large. "The red colour produced by the permanganate of "potash, which is specially advised by Mr. Hankin, is occasionally objected to; but, on the whole, "both the people and the medical officers regard its use favourably in most districts."

5. *Small-pox* accounted for 21,678 deaths; but the mortality caused by it was not excessive except in a single district. The district of Ganjam contributed 14,515, or more than two-thirds of the total number of deaths, giving a death-rate of 11·7 per thousand of its population. In no other district did the small-pox death-rate reach 1 per thousand; whilst for the province as a whole, including Ganjam, it was only 0·7. The history of small-pox for the year was therefore practically its history in Ganjam. There is no doubt that when the disease broke out in epidemic form in Ganjam its dispersion was much assisted, during a year of famine, by the wandering from village to village of people in search

of employment, as well as by the filthy habits and customs of the Uriyas described by the District Medical and Sanitary Officer; but all of these causes would not have brought about an epidemic attended with so great a loss of life had the population been previously protected by vaccination; nor will all other measures combined prevent a recurrence of destructive epidemics if vaccination is neglected. Regarding the Malabar district, which so long returned the highest death-rate from small-pox, Dr. King writes:—"The vaccination staff has been considerably increased, and much attention "has been paid to perfecting the working of the department in this district. The result is apparently "a steady diminution of small-pox. Of course this *post hoc propter hoc* argument is open to the "criticism that a large number of the population are really now protected not by vaccination but by "previous attacks of small-pox." Without claiming for vaccination that it will completely extinguish small-pox in districts such as Ganjam and Malabar, it is safe to assume from general experience elsewhere, that their small-pox mortality will diminish directly as the protection of their population by vaccination increases. From the table given in paragraph 8 of the Vaccination Report it would appear that, excluding municipalities, only 18·0 per cent. of the population of Ganjam were protected by vaccination. The calculation is based on a return of 22,550 births, but according to Statement No. II., page 76, of the Sanitary Report the births in the Ganjam district in the calendar year 1897 numbered 29,634. Perhaps the difference may be due to the number of births in the 12 months covered by the Vaccination Report being so much smaller than the number in the 12 months of the calendar year covered by the Sanitary Report. Even when the 1,232 births in the three municipal towns of Ganjam are added to the 22,550 for the district, the total falls short of the total given in the Sanitary Report by 5,852. The numbers vaccinated in the Presidency during 1897–98 exceeded those vaccinated during the preceding year by 24,009. The percentage of successful cases were practically the same in both years. Infant vaccination showed a slight increase; but the fact that only 331,297 children under one year of age were successfully vaccinated out of a grand total of 935,845 children born in 1897, exclusive of Europeans, Eurasians, and still births, shows how much remains to be done before the number of children under one year of age protected by vaccination can come anywhere near to the number born. If the 158,263 deaths of children under one year of age be deducted from the number born, there would remain available for vaccination 777,582. Deducting from the latter the number successfully vaccinated, there would remain 446,285 unprotected. The circumstance that the 12 months of the vaccination year do not entirely coincide with the 12 months of the sanitary year would not ordinarily detract much from the usefulness of a comparison between the numbers born and the numbers vaccinated in the two twelve-month periods. Undoubtedly, a fair proportion of the children under one year of age is protected in the municipal towns of the Presidency. For all of the municipalities combined this proportion averages 84·0 per cent., and compares very favourably with the proportion of 31·8 for districts. The use of human vaccine lymph has been entirely superseded in the Madras Presidency by animal lymph. The latter gave results which varied according to the mode of using it. Applied direct from calf to arm, the percentage of success was 95·5, and preserved in glass 93·9; whilst when preserved with glycerine the percentage was 85·6 and with lanoline only 82·0. In India, at all events, experience, so far, is in favour of fresh lymph whether taken from the calf or the arm. The superiority of lymph from the former source over preserved lymph is well exemplified in Madras.

6. *Fevers* were credited with a ratio of 9·0 deaths per thousand of population, as compared with 8·0 in the preceding year. The extraordinary difference between the mortality attributed to fevers in Madras and the mortality attributed to them in Bengal, Bombay, and the Central Provinces cannot fail to strike any one who examines the returns of the several provinces. Whilst the death-rate from fevers in Madras is represented by a ratio of only 9·0 per mille of population, in Bengal this ratio is 23·62, in Bombay 24·05, and in the Central Provinces 40·98. It is difficult to believe that, as compared with its neighbours, Madras enjoyed the immunity from fever mortality which these figures would indicate. Up to the month of June of the year under report the mortality from fever in Madras was less than during the corresponding period of the previous year. "The comparative "freedom in the early part of the year," writes the Sanitary Commissioner, "must be ascribed to the "diminished soil moisture proving inimical to the propagation of the germ, in consequence of the "failure of the north-west monsoon of the previous year; this was followed by an access of moisture "with the south-west monsoon, in the presence of a population rendered susceptible to malaria owing "to diminished food supply, by a mortality greater than normal under this head."

7. The mortality from *dysentery and diarrhœa* showed, as was only to be expected, a large increase over that of the previous year. The excess was contributed by districts "of which seven were "formally recognized as suffering from famine, whilst in the others undoubtedly a considerable "grade of distress was undergone." The ratio of deaths per mille of population caused by these diseases was 1·2 as compared with 0·7 in the previous year. There are grounds for believing that in all provinces the mortality from these diseases is understated.

8. In spite of the introduction into the Presidency of *Plague* by three persons who had been visiting Poona, the measures taken were effectual in preventing the spread of the disease from these cases as foci. The Sanitary Commissioner is justified in claiming that "whatever may be in store for "this Presidency in the future, it is, humanly speaking, certain that the measures adopted on this "occasion did, at least, defer its fate." The Government of Madras accepted the advice of the Sanitary Commissioner to refrain from the adoption of "any attempt at quarantine by land or sea for "healthy persons or ships."

9. *Sanitary Works.*—"The water-supply works of Kurnool and Conjeeveram which were in "progress in 1896, were completed during the year under review." A number of water-supply and drainage schemes were prepared and submitted to the Sanitary Board. In paragraph 57 of his Report the Sanitary Commissioner writes:—"No advance beyond that reported last year has been "made in respect to sewage farming. Sewage filtration continues to be satisfactorily practised at "Vizagapatam and Vizianagram." The set of recent opinion amongst practical sanitarians is against the disposal of sewage by discharging it into rivers or the sea, and of night-soil and sweepings by burning them. The old principle of restoring to the soil what has been taken from the soil is again

finding favour; and its soundness being demonstrated by the success attending the use in cultivation of the valuable manures now being wasted or destroyed at much cost. It is claimed that these materials can be disposed of with safety to the public health and with profit to towns by utilizing them as manures. India would seem to be well situated for this method of disposing of the waste products of towns; and the check in the progress of sewage-farming mentioned by Dr. King is matter for regret. Neither in Madras nor in any other province has the scheme for maintaining Village Inspection Books, so far, proved much of a success. To paragraph 65 of his Report the Sanitary Commissioner appends a list of 18 districts in which the scheme is being tried; but an examination of the remarks entered against each district leads to the conclusion that, in many cases, little progress has hitherto been made in the record of useful sanitary notes in these books.

10. To sum up, the year was one of famine and high prices. Following the drought of the latter part of 1896, the first months of the year under report were, owing to their unusual dryness, unfavourable to the production of malarial diseases. Under the influence of privation during the latter part of the previous year and the early months of the year under report, the birth-rate fell considerably, the fall being most marked in the districts declared to be famine stricken. The death-rate rose from a ratio of 20·6 in the previous year to a ratio of 25·4 for the province as a whole; but in the districts affected by famine the rise was much greater. In one of the latter the rise was from 20·6 to 50·1 per mille of its population. Yet, there can be no question that, owing to defective registration, a large proportion of the deaths still remains unrecorded. Cholera was terribly fatal, accounting for a ratio of 4·4 deaths per thousand of the provincial population. In the district of Ganjam the ratio was as high as 12·54 and in several towns exceeded 20 per mille. Small-pox caused over twenty thousand deaths, but its ravages were mainly confined to the single district of Ganjam, in which it accounted for 14,515 deaths. Of this district it is recorded that only 18·0 per cent. of the children under one year of age were successfully vaccinated. The numbers vaccinated in the province show a considerable increase as compared with those of the previous year; whilst the percentage of successful cases continues about the same. Animal vaccine lymph alone is used in Madras. When applied direct from calf to arm it gave a percentage of 95·5 successful cases, but when preserved with glycerine only 85·6, and with lanoline only 82·0. Fever was credited with a death-rate of 9·0. This is probably but a part of the actual death-rate from this cause, seeing that in the adjoining province of Bengal the rate was 23·62, of Bombay 24·05, and of the Central Provinces 40·98. Plague obtained entrance into the Presidency, but the measures adopted to prevent its spread proved successful. Several sanitary surveys have been made and water-supply and drainage schemes prepared for submission to the Sanitary Board. The water-supply works of Kurnool and Conjeeveram were completed during the year.

9th June 1899.

No. 11.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1897.

Famine and plague combined to make the year unhealthy. The former was a continuation of the famine officially declared to exist in the last months of the preceding year, and did not relax its severity until towards the end of nine months of the year under report. Climatically considered, the season of 1897 was not unfavourable to the public health. The early cessation of the rains in the previous year, although disastrous to the crops, was followed by a long period of unusual dryness and a period, consequently, characterized by unusual immunity from malarial diseases. There was no rain for the first three months of the year, and only very slight showers fell in April and May, except in one district. In June the monsoon set in, and continued "throughout the country in a very favourable "way." Outside, as well as in, districts declared to be affected by famine, the prices of food-grains were very high and bore severely on the labouring poor, who form the bulk of the population. Plague added to the sickness and mortality arising from high prices and famine; but the loss of life due to it was small when compared with the anxiety which its progress caused, not in the Bombay Presidency only, but throughout India. After all, the 46,944 deaths attributed to plague do not bulk very largely in a total for the year of 749,916, of which 57,109 were caused by cholera, 85,966 by dysentery and diarrhœa, and 405,652 by fever exclusive of plague.

2. The Report deals separately, as it did last year, with the vital statistics of the European and Eurasian population of the Presidency. As we remarked last year, these statistics relate to communities numerically so small that an attempt to draw general conclusions from them might mislead. This is shown by a comparison of the vital statistics of the year under report with those of its predecessor. The population numbers according to the last census, 18,486 Europeans and 8,519 Eurasians, are used in both years as those on which birth and death ratios are calculated. In 1896 the number of births of Europeans was 294, as compared with 259 in the following year; and the returns record that, whilst of the former number 161 were births of male, only 133 were births of female children. This proportion of the sexes was altogether reversed in 1897, when the male children born numbered 119 and the female 138. The death-rate amongst Europeans did not differ much in the two years, having been 15·69 in 1897, as compared with 16·46 in the previous year, per thousand of population. Amongst the small Eurasian community the death-rate increased from 22·89 in 1896 to 28·17 in the year under report. The 44 deaths due to plague account chiefly for this increase. Only 21 deaths from

plague occurred amongst the very much larger European population. The great majority of the deaths from plague amongst both Europeans and Eurasians occurred in Bombay City ; but it must be remembered that more than half the entire population of these two races in the Presidency live in Bombay City.

3. Amongst the native population, numbering 18,820,346, the birth-rate fell from a ratio of 36·76 in the previous year to a ratio of 33·46 per thousand in the year under report ; and the number of deaths exceeded the number of births by 120,223. Instead, therefore, of there being a "natural increase" there was a considerable decrease of population during the year. Other provinces show even greater decrease ; and their case may serve as a warning that, in a country like India, where the effect of famine and pestilence on fecundity and mortality may be a large loss of population in a single year, the practice of estimating the population between the last and next census by adding to the population of each year a tenth part of the total increase which accrued between the last and its immediate preceding census, might sometimes give rather deceptive results. The City of Bombay itself furnishes a striking example of the violent fluctuations in vital statistics which may follow the outbreak of an epidemic. In the year 1896, the recorded birth-rate was 19·35 per thousand of the population : in the year under report it was 11·29. The explanation of this sudden decrease is not altogether to be found in the directly destructive effects of plague, but mainly in the panic which its outbreak caused amongst the inhabitants, and the consequent exodus of a large proportion of them from the town. This exodus led to a very sensible reduction of the population. The decrease of the birth-rate, it may be assumed, was not due, except in part, to the direct influence of sickness on the inhabitants, but to a smaller number of births naturally occurring in a smaller population. Elsewhere in the Presidency, famine and high prices were chiefly responsible for the decrease in the number of children born, as well as for the increased number of deaths. Whilst there were 62,154 fewer births, there were 153,444 more deaths registered than in the preceding year. These results may be taken as mainly due to the privations which the population underwent in consequence of scarcity and high prices following failure of the crops. In the districts declared to be wholly or partially suffering from famine, the decrease in the number of births and the increase in the number of deaths may be accepted as some measure of the distress to which their inhabitants were subjected. In all of the five famine-stricken districts the deaths exceeded in number the births. For example, in Satara the birth-rate was 31·51 whilst the death-rate was 54·92 ; and in Sholapur the former was 30·77 whilst the latter was 50·89. In each of the other three the number of deaths exceeded the number of births. If with these the birth and death rates in districts not overtaken by famine are compared, it will be seen that in the latter the number of births, as in normal years, generally exceeds the number of deaths. In the Surat district the recorded birth-rate was 40·64 and the death-rate 38·88 ; whilst in Broach the former was 42·39 and the latter 34·63. Instead of registration of vital statistics having deteriorated during the year under stress of plague and famine, the Sanitary Commissioner says this "has been well carried "on in most of the areas owing to the exigencies of plague and famine. The low death-rates under "25 per 1,000 are mostly shown in the talukas of Sind and the Gujrat Registration District." In the Collectorates of the Sind registration district, more especially, registration has always been, and still continues to be, very defective. Two of these Collectorates return death-rates of less than 20 *per mille* of population.

4. *Chief Diseases.—Cholera* caused 57,109 deaths. It prevailed in the end of the preceding year and continued until the end of the year under report. There does not appear to have been anything very exceptional in its course. Its fatality increased rapidly from March until it attained its climax in July, in which month 14,749 deaths were attributed to it. After this, the disease died down, slowly at first, and afterwards more rapidly, until in November only 392, and in December 121 deaths were recorded against it. The first two and the last three months of the year were, as often happens, those of least mortality. In these five cold-weather months only 3,475 of the total number of deaths took place. The disease was most fatal in the famine-stricken districts. In some of the latter the death-rate due to it was very high. In Satara this rate was 9·03 per thousand of population, and in Poona 8·61, as compared with 3·03 for the Presidency as a whole. Of the 220 rural circles 138 suffered, and of the 56 town circles 41 suffered. It is worthy of note that the military cantonments, in which the sanitary arrangements may be assumed to be more complete than in native towns and villages, showed no comparative immunity from cholera. Six out of the eight in the Presidency were attacked. From numbers so small, however, it would be unsafe to draw conclusions.

5. *Small-pox* mortality was less than in the preceding year, and only slightly exceeded the decennial mean. The death-rate for the Presidency was only 0·20 per thousand of population. Of the deaths, 29·46 per cent. occurred amongst children under one year of age, and 46·39 between one and twelve years of age. The year 1897–98 was an unfortunate one for vaccination. The numbers vaccinated showed a net decrease in primary cases of 7·42, and in re-vaccination of 15·36 per cent. "In total "operations there is a decrease of 66,073, or 8·87 per cent." The causes of the decrease were mainly the prevalence of plague and famine. "The exodus from large towns," writes the Deputy Sanitary Commissioner of the Central Registration Circle, "owing to the presence of plague, interfered greatly "with vaccination work in them. Some of the Inspectors and Vaccinators were engaged on plague "duty." He adds :—"Owing to the absence of the people from their villages during the famine, the "usual number of children for inspection could not be obtained." In paragraph 7 of the Vaccination Report, a table is given showing the numbers vaccinated in the Native Army. In this table the number of persons primarily vaccinated in the Native Army is stated to have been 3,384. It is not said that these persons were all sepoys. In India generally, it is somewhat unusual to find natives who have reached adult life without having had an attack of small-pox, unless they have previously been protected against attack by vaccination or inoculation. Under these circumstances the number given in the table seems large, if it refers to sepoys who had never previously been vaccinated, inoculated, or had small-pox. Possibly, men who may previously have had small-pox, or been inoculated, but have not been vaccinated, may be entered as cases of "primary" vaccination. The protection of the infant population is a satisfactory feature of vaccination in the Bombay Presidency. According to paragraph 9 of the Report, 629,693 births were registered during the calendar year 1897,

and during the same year, 136,453 deaths of children under one year of age were registered, leaving available for vaccination 493,240. Of this last number 417,924, or 84·73 per cent. were successfully vaccinated. Of the comparatively small unprotected residue, doubtless a considerable number were found to be unfit to undergo operation, owing to ailments of some kind. The cost of vaccination in this Province is great, averaging 6 annas and 10 pies for each successful case; but with so excellent a record of infant vaccination to show, both the Government and the people get value in protection from disease which well repays the outlay. In a year of famine, where large numbers of people were assembled on the numerous relief works, and when there must have been much wandering from village to village in quest of employment or food, the risks of dissemination of small-pox infection must have been greatly increased, and the comparatively small mortality from the disease was, there can be no room for doubt, largely, if not altogether, due to the protection afforded by efficient vaccination. The Sanitary Commissioner writes :—" The birth and death statistics are taken for the " calendar year, as usual, in calculating the number available for vaccination, because infants are " generally not vaccinated until three months after birth." The percentage of successful cases of primary vaccination, excluding " unknown " cases, was 98·3, and of re-vaccination 79·25. The latter is high, and seems to suggest the need for scrutiny and an exact definition of what constitutes successful re-vaccination. Animal lymph was exclusively used in Bombay City, and its use in the Province generally was extended. The Acting Sanitary Commissioner, who has written the Vaccination Report, remarks in the concluding paragraph :—" The year was a disastrous one for vaccination " work, owing to the effects of famine and plague. In many parts the people were on the move, and " not readily got at, and from many of the large towns there was a large exodus. The death-rate was " high, especially among children, and there was a low birth-rate." He adds :—" The measures taken " for the protection of the famine camps from small-pox were, however, a matter for congratulation, " as vaccination work was carried on systematically in these camps with very satisfactory results. " The attacks from small-pox in these camps were 270, and deaths 20. The figures for the camps " during the famine of 1877 are not available, but the extent of the disease in that year compared with " the present may be judged by the fact that there were 27,369 deaths in the whole Presidency from " small-pox in 1877, while in 1897 there were only 3,835. In addition to the measures taken, this " satisfactory result is due to the good vaccination work which now for some years has been done in " the Presidency." The remarkable contrast mentioned between the small-pox mortality of the two famine years is a good practical illustration of the protective influence of efficient vaccination against small-pox.

6. The number of deaths recorded as due to *fever* includes deaths from plague. Of the latter there were 46,944, and if these are deducted the total of fever deaths fall below the number for the previous year. The same climatic conditions which in other provinces were favourable to a diminution of mortality from malarial diseases, had a similar effect in the Bombay Presidency. The unusual dryness of the first five months of the year under report had the effect of keeping the fever mortality below that of the corresponding months of 1896. During the last six months, after the monsoon had set in, the death-rate considerably exceeded the mean of the ten years from 1887 to 1896. The fever death-rate in the Western Registration Circle, which includes Bombay, was 28·66 per thousand of population. This high rate the Sanitary Commissioner says was chiefly due to the prevalence of plague in Bombay, and adds : " It is quite clear that many plague deaths escaped registration as plague deaths and were " put down to other causes." On the other hand, in the Central Registration Circle, if the 21,667 deaths attributed to plague are deducted from the total fever deaths of that circle, the remainder is less than the number of fever deaths for the previous year. From this it may, to some extent, be inferred that the practice of crediting plague deaths to other causes was not general.

7. *Dysentery and Diarrhœa* had attributed to them 85,965 deaths, as compared with 36,046 in the previous year. The explanation of this enormous increase is the same as that given in the case of similar increase in other provinces which suffered from famine. The diseases are of the class known as " famine " diseases, and their excessive fatality was the consequence of the insufficient and unsuitable food on which large numbers of the labouring classes had to exist during a protracted period of high prices and scarcity. It is more than probable that the large number of deaths credited to these diseases falls considerably short of the actual number. In the Sanitary Report for Bengal, evidence is given in support of the belief that many of the deaths caused by dysentery and diarrhœa are recorded under the head of fever. Dr. Clarkson writes :—" There is no doubt that the large rise " in mortality from dysentery and diarrhœa is due to famine. In areas where famine most prevailed " the mortality is seen to be the highest, and in those areas on the fringe of the famine, such as Thana, " Kolaba, Ratnagiri, Dharwar, and Kanara, the death-rate is also high."

8. Notwithstanding that plague gave abundant opportunities for its study during the year, it can hardly be said that much additional light has been thrown on the origin of the outbreak in India. Whence the disease came or how brought still remains uncertain. Nor has the use of medicines in the treatment of the disease, so far, appreciably influenced the rate of mortality amongst those attacked. Much has been heard of the success of prophylactic treatment by inoculation; but whilst some have claimed that a certain degree of immunity is conferred by this method of prevention, others maintain that its efficiency still remains to be proved. The measures adopted to prevent the spread of plague have been modified from time to time in accordance with the experience acquired in carrying them out. They have been costly, and have caused much inconvenience and some irritation amongst the people. Doubtless they may have been effectual in retarding or, in some cases, in preventing the dissemination of the disease; but it is only two evident that, in spite of them, plague has found its way into nearly every province of India. Some think the measures would have been successful had they been more stringent. There is a point in the stringency with which they can be applied in India, when further stringency would probably defeat the purpose for which they were devised. One of the methods of dealing with outbreaks, regarding which all are probably unanimous, is the prompt and complete evacuation of infected towns and villages. Unfortunately, in the case of great cities like Bombay and Calcutta, such a method in its entirety would be impracticable; but where practicable and properly carried out it has perhaps rarely if ever failed to be of decided benefit, or even to be completely successful.

9. *Sanitary Works.*—We miss from this Report Statement No. XI., showing the chief sanitary defects in the municipalities of the Presidency and the measures adopted for their remedy. In their preliminary remarks the Sanitary Board state :—" The year under report does not show any " great progress in sanitary work. Owing to the special measures taken by Government due to the " plague, the ordinary sanitation of towns and villages has been much better looked after, and the " general state of cleanliness is probably better than it has ever been, and the Board hopes that this " state of things may continue after the plague has passed away ; but unless municipalities are dealt " liberally with as regards plague expenditure, many projects will be delayed indefinitely for want of " funds." It is satisfactory to learn that sewage farming is making progress. The municipality of Karachi, instead of wastefully discharging the town sewage into the sea, utilises it on a farm " which " is a remarkable instance of the success, both financially and from a sanitary point of view, of Broad " Irrigation carried out intelligently and under proper supervision." The example thus set by Karachi could no doubt be followed by many other municipalities. By way of contrast, a remark may be quoted from paragraph 26 of the Board's Report concerning the disposal of sewage at Poona. " That sewerage is a necessity can be seen by visiting the spot where the foul-smelling sullage is " discharged from carts into a small stream which joins the stretch of water above the Jamsetj Bund ; " and this piece of the river is becoming very foul."

10. *Summary.*—Famine and plague combined to raise the death-rate and lower the birth-rate. The number of deaths exceeded the number of births by 120,223. Climatically regarded, the year was not an unhealthy one. The unusual dryness of its first months, consequent on the early cessation of the monsoon of 1896, had the effect of lessening the prevalence of malarial diseases. Fever during the first five months was less fatal than in the corresponding months of the preceding year. Although high prices prevailed everywhere, famine was officially declared to exist only in five districts, and scarcity, not amounting to actual famine, in four others. The famine-stricken districts show the effects of the privations which their populations endured by their high death-rates and their generally low birth-rates. Cholera carried off 57,109 victims. There was nothing very unusual in its history. The two first and the three last months of the year were those of lowest cholera mortality. Some of the famine-stricken districts suffered severely. The Presidency enjoyed a remarkably immunity from small-pox mortality in a season apparently favourable to its spread, a season in which there were large collections of people employed on relief works, and in which there was much wandering of destitute persons from town to town and village to village. It is safe to attribute this freedom from unusual small-pox mortality to efficient vaccination. The deaths numbered only 3,835, a number in striking contrast with the 27,369 recorded in the previous famine year of 1877, before vaccination had reached its present state of efficiency. Next to lessened mortality from small-pox, perhaps the best measure of the efficiency of vaccination is the proportion of the infant population annually protected. In the Bombay Presidency, 84·73 per cent. of the children under one year of age were successfully vaccinated. In the neighbouring Presidency of Madras, this proportion was only 31·8 per cent., excluding municipalities, and the death-rate from small-pox was 0·7 per 1,000 of population, or more than three times the Bombay rate of 0·20. Bowel complaints were very destructive of life as they usually are in seasons of famine. Plague accounted for 46,944 deaths, and, in spite of the measures taken to prevent its spread, was carried to many and distant parts of India. Although the expenditure due to the combat with plague and famine crippled the resources of the Province, the dread of a visit from plague doubtless aroused both urban and rural authorities to the need for sanitary improvement. The result has been that, in the opinion of the Sanitary Board, the general cleanliness of both towns and villages is probably better than it ever was before.

9th June 1899.

No. 12.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1897.

The acute distress following the scarcity which prevailed during the preceding year continued until the autumn crops had been reaped in 1897. A long period of high prices and hard times had enfeebled the people and made them fall easy victims more especially to fevers and bowel complaints. " The maximum temperature was above the mean but below that of the previous year " ; whilst the rainfall exceeded that of the previous year by about six inches and was below the average of the preceding ten years by about the same amount. The price of *jowari*, the staple food-grain of the province, stood at 22 seers per rupee in September 1896, and rapidly rose until in November it was more than double. After a slight fall to nearly 12 seers in January of the year under report, the price again increased until it reached its highest point in August : in this month only a little over seven seers could be bought for a rupee. The movement in the price of *jowari* during the period of famine is well shown in the diagram on page 10 of the report. The public health could not but suffer under the conditions described. "The death-rate of the year was 52·6 per 1,000, or 33 per " cent. in excess of the quinquennial average. The main cause of the high mortality was the famine " —that is to say, local scarcity and high prices combined with immigration of starving people from " the Central Provinces."

2. *Vital Statistics.*—Much attention continues to be bestowed on registration in Berar ; and the birth and death rates show that it is not bestowed in vain. During the year under report the recorded birth-rate was 39·7 and the death-rate 52·6. Of nearly five thousand registers inspected by

district authorities, 4 per cent. were found to be defective. But it is evident from an examination of the proportion of registers found to be defective by the different officers, that the strictness of the scrutiny to which the registers were subjected must have varied considerably. Whilst Deputy Commissioners detected defects in 8·5 of the registers examined by them, Attachés, Assistant and Extra Assistant Commissioners detected only 1·6 per cent. Even a greater difference is seen to have characterised the testing of registers in the different districts. In Wún, out of 895 tested 84 were found to be defective, as compared with only three out of 483 in Ellichpur. The number of births and deaths found by the district authorities to have been omitted from the registers is not given. In upwards of three thousand registers examined by Superintendents of Vaccination, omissions were discovered in 5·4 per cent.; and the number of births and deaths found by them to have been omitted was 218 of the former and 131 of the latter. In municipalities more attention is said to be given to registration. The table on page 3 shows that in municipal towns there were 128 prosecutions for failure to register births or deaths. By the persistent efforts made in the past, and still being made, to improve registration, the vital statistics of Berar are attaining to a condition of approximate accuracy. Already, they may be relied on with some confidence to afford valuable information regarding the incidence of disease and the general health conditions prevailing among the people of the province.

3. The recorded *birth-rate*, which was 39·7, varied little in any of the six districts of the province excepting Basim, in which, owing, as the Sanitary Commissioner thinks, to defective registration, it was only 37·0. It tends to increase confidence in the substantial correctness of the registration of births to find the recorded proportion of male to female children born to be 106·7 of the former to every 100 of the latter. "In August the registered births fell below the mean and remained below it "during the remainder of the year." The months of August, September, and October are those in which the highest number of births is usually recorded; but in the year under report there was a diminution below the average recorded in the last five months of the year. Here again, there can be little question that the birth registration is consonant with the facts, and that the distress which prevailed during the last months of 1896 and was prolonged into the year under report led to a falling-off in the birth-rate. "The results of our inquiries," writes the Sanitary Commissioner, "at "relief camps and poor-houses went to show that pregnancy was a rare condition amongst the women "driven by famine pressure to these centres of relief." This is in accordance with general observation under similar conditions in other provinces.

4. The *death-rate* was 52·6 *per mille* of population, and has been but once exceeded in Berar, and then only in the famine year of 1878, when a rate of 81·5 was recorded. The death-rate in the several districts shows no such uniformity as the birth-rate. In Amraoti it was 61·1, in Basim 43·5, and in Wún 42·1. "The high *death-rate* in the Amraoti district as compared with others, is to be "explained by the fact of its situation as regards the Central Provinces, from which territory the "starving poor flooded the district, seeking for work and food. Numbers of these persons died from "the effects of chronic starvation, from which they suffered before reaching Berar, with the result of "unduly raising the death-rate." The mortality in towns was similarly swelled by the influx of numbers of famine-stricken persons attracted by the arrangements made for the systematic administration of relief. The one exception to a record of a high death-rate in towns was Ellichpur; and in this, the remarkably low rate "is only attributable to defective registration." As is usual under similar conditions, the very young and the very old suffered most. Children under one year of age died at the rate of 378·4 per 1,000 of those living at that age; and persons exceeding 60 years of age at the rate of 138·7. Persons of from 10 to 20 years suffered least. The aboriginal tribes in Berar, as in the Central Provinces, died in great numbers, and, doubtless, from a like cause. Living in places difficult of access, of timid and shy disposition, their effectual relief when overtaken by famine was a matter of the utmost difficulty. The provincial mortality during the three months of August, September, and October, was very great, and fell but little short of the total mortality of the other nine months of the year. "Out of a total rainfall of 34 inches 7 cents., 30 inches fell in the "months of July, August, and September, and the resulting atmospheric vicissitudes, accelerated the "fatal ending to which numbers of the half-starved wanderers in our poor-houses were hastening."

5. *Chief Diseases.*—During 1897, as during the two preceding years, *cholera* prevailed with much severity, the recorded death-rate having been 3·5 *per mille* of population, and 4·4 and 4·2 in each of the two previous years. The Sanitary Commissioner predicted that, after the epidemic of 1896, cholera would, in accordance with its usual behaviour, probably be in abeyance during the following year. His anticipations were not fully realized for the province as a whole; but an examination of the returns for each of the six districts shows that the two districts of Wún and Basim which suffered most in 1896 suffered least in the year following. To this extent the Sanitary Commissioner's prediction was fulfilled. The disease was, however, present in every district, and prevailed in 96 registration circles as compared with 97 in the preceding year. We are told that the Civil Surgeons, as usual, submitted detailed reports of the cholera outbreaks in their districts, but that these reports elucidate nothing new in the etiology or mode of spread of the disease. The Sanitary Commissioner adds:—"Suffice it to say that insanitary surroundings and an impure or infected water-supply were "generally shown as associated with these outbreaks." Regarding the use of permanganate of potassium for the purification of wells, we are told that "the general opinion appears to be that this has a "beneficial effect." Such a general statement does not carry very great weight. Exact experiments and observations are still wanting on which to base conclusions as to the effect which the permanganate of potassium treatment of wells exercises in controlling cholera outbreaks. Dr. Roe notices one very practical obstacle in the way of the general employment of this method of water purification. The number of wells in a Berar village or town, he says, makes systematic disinfection almost impossible. The Sanitary Commissioner has introduced, at page 12 of his report, a very useful table to show the total mortality and death-rate from cholera in each district of the province for the year under report, as well as for the 26 preceding years. He says:—"This and similar tables "for the other chief diseases are a useful series for reference and have therefore been retained *in extenso*."

6. The provincial death-rate from *small-pox* was only ·2 *per mille* of population. The disease was more than twice as fatal in urban as in rural circles. A list of towns is given in which a high death-rate prevailed, and the Sanitary Commissioner thinks it highly discreditable to the responsible officials of these towns that this should be so. Considering the distress and sickness which prevailed throughout the province, it is satisfactory to find that not only was there no falling off in the numbers vaccinated as compared with the numbers vaccinated in the official year 1896–97, but that there was a substantial increase of 5,289. The percentage of successful cases in primary vaccination was 96·4 as compared with 96·8 in the previous year. In re-vaccinations the percentage of successful cases was 30 as against 20·5 in the preceding year. The Sanitary Commissioner writes :—"The ratios of 45·9 and 36·9 in the Ellichpur and Buldana districts "are too high. I do not consider them reliable." But if he considers so high percentages to be unreliable, it would be interesting to have his opinion of the corresponding figures for Madras and the Central Provinces. These, for the former, are 81·0, and for the latter 87·87, according to Statement I. of the Vaccination Reports for those provinces. Dr. Little's remarks on this question of the percentage of success in cases of re-vaccination are worth quoting :—"When primary vaccination "has been properly performed, the individual is protected totally or in part against cow-pox and "small-pox, and the amount of susceptibility remaining is generally so slight that in the majority of "cases re-vaccination only results in the development of papulæ, which last but a day or two, or may "produce little more than mere local irritation, which the inexperienced would wrongly record as "successful. Superintendents must be more careful in checking vaccinators' results under "re-vaccination." A satisfactory feature of the season's work is the high percentage of infants protected against small-pox. Of the infants available for vaccination 93·3 per cent. were successfully vaccinated. In another respect the work stands in favourable contrast with that recorded in the contiguous Central Provinces. Whilst in Berar 2,847 persons were vaccinated by each vaccinator during the year, the number in the Central Provinces was 1,391, or less than half. The table given on page 4 of the Vaccination Report shows the mean death-rate from small-pox for quinquennial periods beginning with the year 1868–69. The mean for the first quinquennium was 2·02, for the second 1·56, for the third 0·58, for the fourth 0·38, for the fifth 0·2, and for the last 0·19. Dr. Little may well say : "The above figures tend to prove the axiom that in countries where there is much "vaccination and re-vaccination relatively to the population, there is but little small-pox."

7. *Fevers* were not greatly more fatal than during the preceding year, and were somewhat less so than during 1894 and 1895. Their seasonal incidence did not much deviate from the normal, the greatest number of deaths taking place in the autumn months. As in the famine of 1878, "the "enfeebled condition of the people due to insufficient food caused them to die in unusual numbers "during the monsoon months when malaria was rife." But fortunately the destruction of life caused by fevers in the famine year under report was small in comparison with what was caused by them in 1878. In the former year the ratio of deaths from fevers was 23·0, and in the latter 38·9 per thousand of the population.

8. *Dysentery and Diarrhœa*, the scourges of the ill-fed and famine-stricken, were, as might have been anticipated, unusually fatal. We have to go back to the famine year of 1878 to find so high a death-rate from these diseases. In 1897 the recorded rate was 10·3 as compared with 6·2 in the previous year, and with 12·6 in 1878. "The famine distress in itself is sufficient," writes the Sanitary Commissioner, "to account for the great increase of mortality under this head, as diarrhœa and "dysentery are the usual ending in chronic starvation." Dr. Little finishes his report with a valuable account of the famine regarded from its sanitary and medical aspect. This account will enable any one who may read it, to gather a clear idea of the effects of starvation on the physical condition of the people. The practical lesson which it teaches is the need for early relief, if suffering, inevitably ending in death, is to be prevented. After a certain stage of starvation has been reached, recovery becomes hopeless, no matter what the diet provided, or how careful the nursing, or skilful the medical treatment. "Of all famine diseases, diarrhœa was the most common, due to pathological changes in "the mucous membrane of the intestinal canal, which once seriously affected by degenerative changes "dependent on insufficient nourishment cannot be renewed, and no food, however nutritious, will be "digested or assimilated." As Dr. Roe, the Civil Surgeon of Amraoti, writes of those who had reached this stage of chronic starvation, "Diet seems a matter of indifference, milk and soup having "no beneficial results. In most cases of this kind, death ultimately results from chronic diarrhœa or "dysentery. Some were under treatment (or rather feeding) for months. They eat well and seem "to be fairly well, but they did not put on an ounce of weight."

9. *Sanitary Works.*—During a year in which the resources of the administration were fully employed in the combat against famine, it was not to be expected that sanitary improvements could receive so much attention as in ordinary seasons. Yet, the Sanitary Commissioner writes: "The "rate of sanitary progress in municipalities, though it has been slow, has nevertheless been steady, "and wherever improved water-supply, drainage or conservancy has been effected, it has been "appreciated generally by the people." The chief sums expended on municipal sanitation came under the head of water-supply, drainage, and domestic cleansing. Under the first of these heads close upon 60,000 rupees were expended, whilst upwards of 10,000 were spent on drainage, and nearly 67,000 on domestic cleansing. On district sanitary works, just over a lakh of rupees were spent, and of this amount nearly 43,000 rupees were expended in the single district of Amraoti.

10. Briefly summarised, the history of the year was one of famine, much sickness, and great mortality. Not since the disastrous famine year of 1878 has the death-rate of 52·6 been exceeded. The birth-rate of 39·7, when compared with that of other provinces, was high. Both births and deaths appear to be registered with approximate accuracy, the result of years of persistent attention to registration. Cholera mortality showed some abatement as compared with the mortality for the two preceding years, but was still high. Small-pox was credited with a death-rate of only 0·2 per 1,000 of population. The recorded mortality from this disease shows a steady decrease since 1868–69, from a mean ratio of 2·02 in the five year period commencing with that season, to a mean ratio of only 0·19

in the year 1897–98. This satisfactory result can only be attributed to the progress which vaccination has made in the Province. Fevers and bowel complaints, especially the latter, were unusually destructive of life. The enfeebled condition of the people, resulting from prolonged privation, doubtless led to the high mortality from these diseases. The Sanitary Commissioner confirms what has been taught by the experience gained in previous famines, that, to be effectual in saving life, relief must be given early. After a certain stage of chronic starvation has been reached, no expenditure on diet, nursing, or medical treatment will be of avail. It was not to be expected that sanitary works would make rapid progress during a year in which the resources of the Province were strained to the utmost in relieving distress.

9th June 1899.

No. 13.

Memorandum by the Army Sanitary Commission on the Administration Report of the Town of Calcutta for 1897–98.

The Report was mostly written by Dr. Sen, who officiated as Health Officer during the interval between Dr. Simpson's retirement on the 6th of September 1897 and the arrival of Dr. Neild Cook on the 7th of January 1898. On the influence on the public health of the meteorological conditions of the year no remark is made. The price of food was much higher than the average of the preceding 10 years. This dearness of food no doubt had an unfavourable influence on health, and the death-rate was, with one exception, the highest recorded since 1889. The birth-rate would, of course, be more affected by the price of food prevailing during the preceding year than by its price during the year under report. As a matter of fact, it was practically the same in both years.

2. *Vital Statistics.*—The recorded *birth-rate* was 18·4 per thousand of population; but there are good reasons given for the belief that the registration of births and deaths, but more especially of births, is "ill-performed, owing to its being left mainly, if not altogether, to the discretion of the residents." It is stated that when the parents or friends of newly-born children neglect to present themselves at the ward offices, the births are rarely discovered by the registering officers. It is added that when unregistered cases of births are discovered, prosecutions are instituted against the parties responsible; but, as only 36 such prosecutions were recorded during the year, discovery would not appear to be frequent. How far the low birth-rate in Calcutta is due to defective registration and how far to predominance of males in the constitution of the population cannot be ascertained with exactness: it is most likely due to both causes. An "efficient organisation," the want of which the health officer deprecates, for the collection and record of vital statistics is absolutely essential if the influence of local insanitary conditions on the health of the inhabitants is to be measured with some approach to accuracy. The recorded *death-rate* for the year was 36·1 per thousand of population. The registration of deaths is "better done" than the registration of births. This is probably the case everywhere in India. In Calcutta the accuracy of the death returns depends chiefly on the records kept of the corpses burnt or buried at the cremation grounds and cemeteries. Even this does not secure the record of all the deaths: "a small margin is often "left of cases in which the bodies of the dead are disposed of either at places beyond Calcutta or in "cemeteries in town with which no arrangement exists for the supply of death-returns." The method by which the registration of deaths is effected, whilst securing an approximately correct record of the number of deaths, affords no reliable statistics of the *causes* of the deaths. According to the Health Officer more than half of the people who die in Calcutta are not attended in their last illness by a medical practitioner of any sort, and the causes of deaths reported at the cremation grounds and cemeteries in the majority of instances depend on the mere statement of the friends of the deceased. Altogether, it is obvious that there is urgent need for improvement in the system of registration of vital statistics in Calcutta. A remark made in the 6th paragraph of the report regarding the relative numbers of males and females born, does not appear to be quite accurate. It is stated that "the male births fell below the female births in only three districts, namely, the added "area of Moocheepara, Baniapooker, and Khidderpur": but on referring to the statement of births in the table facing this remark, we find under the heading of "number of births (born alive) during the year 1897," that 54 males were born to 37 females in Moocheepara, 346 to 303 in Baniapooker, and 150 to 122 in Khidderpur. The number of still-births in Calcutta was 979 against 897 in 1896; and gives a ratio of 7·9 still to every 100 live births. This ratio is rather more than half that recorded in Bombay and nearly four times that recorded in Madras. The high death-rate amongst infants, which in past years has constituted one of the most unfavourable features of the mortality statistics of Calcutta, shows no tendency to decrease. As the Health Officer remarks regarding the ratio of 458·5 for the year under report: "These figures serve to show that not only was the "infant mortality in 1897 in excess of the average of the previous five years, but, what is perhaps "of still greater consequence, that the mortality amongst infants has been almost steadily increasing "since 1892." Some of the insanitary conditions which especially affect infant life are noticed, and amongst them those relating to the milk supply of the city. On referring to the account given of laboratory work in paragraph 29 of the Report, we find that of 108 samples of milk analysed 76 were found to be adulterated and two more to be of inferior quality. From this, it would appear that what should be one of the chief articles of a child's diet is rarely procurable in Calcutta of wholesome quality. Where insanitary conditions prevail, the feeblest members of the population,

the very young and the very old, are the chief sufferers. "If the numbers of deaths at different "ages be considered in relation to the proportion of the population at those respective ages, it will be "seen that while the death-rate per 1,000 of the population between the ages of five and sixty is not "excessive for an oriental city, that between the ages of one and five years is at least five or six "times what it should be in a healthy town." The children of the town suffered more severely than those of the suburbs. In the former, of 1,000 children born, 501·7 died within the first year of life, as compared with 394·2 in the suburbs. If their destructive influence on child life may be taken as a measure of their intensity, the insanitary conditions prevailing in Calcutta town are probably almost without parallel in any other large city.

3. *Chief Diseases.*—The number of deaths due to *cholera* showed a decrease, as compared with the number in the preceding year, of 1,100; but was still the third highest recorded since 1889, the first year for which statistics for the city and suburbs combined are available. The death-rate, amounting to 3·4 per thousand of population, cannot but be considered high. The ratio for the Province of Bengal for the year was also high, but fell considerably short of that for Calcutta, having been 2·76. Cholera being declared by many who write about it to be chiefly, or solely, a water-borne disease, the portion of the Report describing the quality of the water-supply during the year is of special interest. In paragraph 5 we are told that "the quantity of filtered water for drinking and other "domestic purposes supplied to the town averaged 30 gallons daily per head of the population. The "supply maintained its general purity throughout the year." It may be concluded from this, that the supply was both abundant and of satisfactory quality. On the other hand, samples of water taken from 63 tanks in different parts of the town were examined, "and all except 5 were found to be unfit for any domestic use." The presence of the *comma bacillus*, it is stated, was detected in only 7·7 per cent. of 839 samples of water from the river, tanks, wells, bathing-platforms, &c. In none of the samples of filtered water was it found. In consequence of the detection of the *bacillus* in the unfiltered water supplied to the bathing-platforms during the previous year, and the synchronous prevalence of cholera, it was concluded that the supply of unfiltered water was dangerous to the public health, and a recommendation made that filtered water should be supplied instead. This recommendation has been acted on, but with what results is not stated. It is certainly the fact that cholera was less fatal during the year under report than during the preceding year; yet the death-rate exceeded the provincial rate and also the mean of the period 1889-96. It is disappointing to find that, although considered by many to be "solely a water-borne" disease, cholera has continued to prevail with persistent severity in spite of the supply of filtered water having been both abundant and of satisfactory purity; and that the mortality due to it exceeds the mortality for the Province of Bengal, in which the water as a rule is neither filtered nor specially protected.

4. *Small-pox* caused 161 deaths as compared with only 69 during the preceding year, and with an average of 469 during the years 1892-96. It appears that all of the 161 deaths recorded did not take place amongst Calcutta residents, 17 of them having occurred in the Campbell Hospital among patients "admitted there from places beyond the limits of Calcutta." The disease cannot be said to have prevailed in very severe epidemic form at any period of the year. In May, during which 37 deaths were recorded as due to it, the disease had attained its climax; and during the remaining seven months of the year only a total of 21 deaths was attributed to it. Of the 161 persons reported to have died of small-pox, 103 were unprotected, 30 vaccinated, and 20 inoculated, whilst one had previously had small-pox. In the remaining seven cases no information as to previous protection, or its absence, was obtained. This statement is suggestive of the persistent activity in Lower Bengal of the inoculator. Where inoculation is practised, small-pox contagion can rarely be absent; and outbreaks of the disease will be frequent unless the population is efficiently protected by vaccination. During the year under report the prevalence of small-pox acted as a stimulus to vaccination, with the result that the number of persons vaccinated was 21,620, or almost twice as great as in the previous year, when it was only 11,976. The increase was chiefly in the number of re-vaccinations, which rose from 2,526 to 8,323. The ratio of success in primary vaccination, calculated on the ascertained cases, was 97·59 per cent. Similarly calculated, the percentage of success in re-vaccination cases was 16·51. Anyone who gives attention to the percentages of success recorded in re-vaccination in the different provinces and cities of India, cannot fail to be struck by the extraordinary contrasts which they present. The record in Calcutta of a percentage of 16·51 of successful cases as compared with 86·97 in Madras city, and with 87·87 in the Central Provinces, seems to suggest difference in the estimate of what constitutes a successful case of re-vaccination rather than difference in the actual results. The Health Officer gives figures to show that few of the children born in Calcutta during 1896 have escaped vaccination, and adds :—"Although the protection of the infant population, so far as the "children born in Calcutta are concerned, cannot be considered altogether unsatisfactory that "protection takes two years time for its accomplishment; so that a large proportion of the population "remains unprotected for over a year from birth. This defect in the due and early protection of the "infant population of Calcutta can only be remedied by a reduction of the period from birth, during "which compulsory vaccination cannot be legally resorted to." In a city from which small-pox contagion is probably seldom absent, the extension to a year of the limit of time within which parents are allowed to keep their children unvaccinated, seems unnecessarily to subject the children to risk of contracting the disease proportionate to the length of time they remain unprotected. The reduction of the age limit for vaccination recommended by the Health Officer would diminish this risk, and, so far as can be seen, would be counterbalanced by no disadvantages to either children or parents. The vaccine lymph used during the year was of three kinds, and of the three, humanised lymph, used in 816 cases, gave the highest percentage of success. Lymph applied direct from the calf gave a percentage of success of 97·32, lymph made into a paste with lanoline of 98·01, and humanised lymph 99·87.

5. To *fevers* and *bowel complaints* were attributed a number of deaths above the average for the previous eight years. The Health Officer observes that, leaving out the year 1895, which was specially unhealthy in respect of fevers both in Calcutta and in the province of Bengal as a whole, the fever "death-rate has risen during the past nine years in almost the same proportion as the price of food,

" giving the high ratio of 14·1 *per mille* of the population, which is not much below half of the total " death-rate in the year 1897, when food rose to a scarcity price." The former Health Officer, Dr. Simpson, traced, also, a relationship between the fever mortality and sewerage system of Calcutta, and endeavoured to show that the benefit to the public health following the drainage of the urban area was gradually disappearing, owing mainly to obstruction to their outfall converting the sewers into sewers of deposit, and to the consequent saturation of the soil with the sewage thus held up and unable to escape.

6. The continued prevalence of plague in Bombay and other parts of India caused much anxiety in Calcutta, and led to the adoption of stringent measures with the object of preventing the introduction of the disease by passengers or goods. It was considered necessary to have all persons arriving in Calcutta by rail from infected provinces medically inspected as soon as possible after their arrival, and to place them under surveillance for 10 days. The ineffectual nature of this " surveillance " soon became manifest, and, in consequence, the Health Officer recommended that " all travellers without exception should be quarantined at the quarantine camps for a sufficient length of time to " remove, so far as possible, the chance of infected persons finding their way to this city and that " there should be also a medical inspection at Howrah and Sealdah of such travellers as passed " through the quarantine camps, as well as a combined medical and police surveillance of all such " travellers in Calcutta for at least 10 days from arrival." Whether effect ever was, or could have been, given to this recommendation is not definitely stated. The inconvenience, hardship, and oppression to which the enforcement of such a measure would give rise in India, could be justified only by its success in preventing the introduction of plague. As a matter of fact plague did not visit Calcutta during the year 1897. Whether this immunity resulted from the measures of quarantine adopted, must be mostly a matter of opinion and speculation. The history of plague during the year following that under report will be of use when the time comes for estimating the effect of the quarantine measures taken for the exclusion of the disease from Calcutta. The Health Department was not unprepared for dealing with plague should it, in spite of all precautions, have obtained entrance into the city. Elaborate arrangements were made for the segregation and disinfection of the infected and for the accommodation and treatment of the plague-stricken in hospitals, even to the disposal of the bodies of those who might die from the disease. To the Health Officer's report a note on " plague precautions " is added by Dr. Neild Cook. Amongst other measures, Dr. Cook strongly advocates prophylactic treatment by inoculation with Haffkine's Plague Serum, and the destruction of rats : " the officers who have most experience of plague are of opinion that the infection " is mostly carried by rats." If this opinion is based on fact, the task of those who would trust to quarantine for the control of plague diffusion must seem a difficult one.

7. Of *sanitary works* in progress during the year the most important were those connected with the two unfiltered-water extension schemes, one for the town area and the other for the suburbs ; and the new drainage works, of which the foundation stone was laid at the end of 1896. It is stated that these important works were vigorously pushed forward, and satisfactory progress made during the year.

8. Briefly, the year, as measured by the death-rate, was not a healthy one. The general mortality was greater than that of the previous year, and exceeded the average of the previous five years. The price of food was much higher than the average of the preceding 10 years, and without doubt had an unfavourable influence on the public health. Good reasons are given for the belief that registration of vital statistics, and more especially of births, is very defective and in need of being organised on an improved system. Perhaps there is no better test of the health of a town than that supplied by its infant death-rate. Measured by this, Calcutta has probably few, if any, equals in unhealthiness amongst great cities. More than half of the male children die in urban Calcutta before they reach one year of age. The death-rate amongst infants of both sexes for urban and suburban Calcutta combined is 458·5 per thousand in the first year of life. In spite of an abundant supply of filtered water for domestic purposes, the cholera death-rate was 3·4 *per mille* of population, and exceeded the provincial rate, which was 2·76. Small-pox was epidemic and caused 161 deaths. Its prevalence acted as a stimulus to vaccination, and the numbers vaccinated increased from 11,976 in the preceding year to 21,620. The percentage of success in re-vaccination cases was only 16·51 : figures in striking contrast with those furnished for Madras City and for the Central Provinces, which give respectively ratios of 86·97 and 87·87. Good reasons are given by the Health Officer for recommending that the period of one year, within which parents are not obliged to have their children vaccinated, should be reduced. The mortality from fevers and bowel complaints was above the average for the previous eight years. Until the drainage scheme in progress has been carried out, marked decrease in the mortality from these diseases is not expected. Fortunately, Calcutta escaped a visitation of plague during 1897. To what extent it owed its immunity from the disease to the quarantine measures adopted to keep out infection cannot be exactly determined. Sanitary works on a vast and costly scale are being vigorously pushed forward.

10th August 1899.

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No. 14.

Memorandum by the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1897–98.

The year 1897 was healthier than its predecessor. Whilst the birth-rate remained nearly the same as in 1896, showing a slight increase, the death-rate fell considerably. The most marked meteorological features of the year were excess of temperature and abnormal rainfall. From the 15th of October until the close of the year, only 9·43 inches of rain were recorded against an average of 26 inches. The high prices of food, which commenced in 1896, continued during the year under report, causing much distress amongst the poorer classes, "and exercising a potent influence on their mortality." The table given in paragraph 184 of the Report shows the very high rates which ruled throughout the year, more especially in the price of second-quality rice and of *ragi*, the ordinary food grains of the poor.

2. *Vital Statistics.*—A birth-rate of 41·3, and a death-rate of 35·5, show that the registration of vital statistics in the City of Madras is carried out with probably a close approximation to accuracy. The constrast between the rates of births and deaths in the City and in the Presidency as a whole, is very striking. Whilst, as just stated, Madras City records a birth-rate of 41·3 *per mille* of its population, the Presidency records a rate of 28·7 ; and whilst the former records a death-rate of 35·5, the latter records a death-rate of only 25·4. As stated in the Report, increase in the number of births during the year, slight although it was, "must be received with satisfaction, considering the distress induced "by famine, which was felt in the town as well as in the Presidency. The birth-rate of a population "being directly influenced by its prosperity and adversity, it would not have been surprising if a "considerable reduction in the birth-rate had occurred." The contrast between the birth-rate recorded for the City and that recorded for the Presidency is sufficiently striking ; but, when compared with 11·36 recorded in Bombay during the same year, it shows to what extent "adversity" had overtaken the latter city. For Madras, only 2·2 still-births to every 100 live-births were registered ; but the President of the Municipal Commission thinks the ratio is unquestionably too low for a city like Madras. In Bombay, more than 14 still-births were recorded for every live-birth ; so, if the ratio is understated in Madras, it is probably overstated in Bombay. The proportion of male children born approximates very closely to that of female children born, having been 101·5 of the former to every 100 of the latter. This approximation may be accepted as some proof of the accuracy of the registration in Madras. As a rule, in India the divergence in the relative number of male, as compared with female children born, increases directly as the defective nature of the registration. The decrease in the death-rate was mainly owing to less mortality from fevers and bowel complaints. Probably the decrease in the fatality of these diseases was, in part at least, owing to the comparative dryness of the latter months of the year. As already stated, the rainfall between the 15th of October and the end of the year amounted to only 9·43 inches as compared with an average of 26 inches.

3. *Chief Diseases.*—Although it prevailed in epidemic form, small-pox cannot be said to have been excessively fatal. The 114 deaths caused by the disease, represent only a death-rate of 0·2 *per mille* of population. Of these deaths, 91 occurred amongst unvaccinated persons, and 13 amongst persons said to have been vaccinated but who had no marks; whilst 10 occurred amongst those who had previonsly been vaccinated. Of the 149 unvaccinated persons who were attacked 91, or 61·0 per cent., died ; whilst of the 44 vaccinated persons attacked only 10, or 22·7 per cent., died. Owing to the high proportion of the population protected in the City of Madras by vaccination, the small-pox epidemic does not seem to have got out of control. The greatest number of deaths due to the disease in any one month took place in August, when 15 persons died of it. In September it caused only eight deaths, and only a total of nine deaths during the remaining three months of the year. Vaccination, re-vaccination, disinfection of the houses and clothing of those attacked, and, when practicable, isolation of the affected, appear to have kept the disease in check. It is curious to find in some reports the outbreak of small-pox assigned as one of the reasons to account for a decrease in the number of persons vaccinated. If vaccination is the efficient prophylatic against small-pox disease which it is proved beyond reasonable doubt to be, it might be expected that, in the presence of a danger against which it is a protection, people would have recourse to it more readily than when such danger is less imminent. In Madras during 1897–98, a year of epidemic small-pox prevalence, the total number of cases of vaccination increased from 27,021 in the preceding year to 33,082, "and the increase was chiefly "due to the prevalence of small-pox in an epidemic form during the latter part of the year under "review." The thoroughness of the system of verification of vaccination in Madras may be gathered from the following quotation from the Report :—"During the year 1897–98, 1,991 cases voluntarily "resorted to the Vaccine Depôts for the inspection of the vaccinator, and in 24,410 cases the results "were verified by the Divisional Vaccinators under Byelaw 11, and, after inspection, certificates of "success were issued to the parents or guardians at their own houses. These results were again "inspected by the Deputy Inspector and four Assistant Deputy Inspectors." Under the revised vaccination byelaws, which have received the sanction of the Government and come into force on the 1st April 1898, the parents of children are bound to produce the vaccinated children at the Depôts for the inspection of the vaccinators. There was a very considerable decrease in the number of persons prosecuted for failure to comply with the vaccination byelaws as compared with the number in the previous year. The results in the case of the 424 prosecutions instituted were that, 316 of the children were vaccinated, in 19 cases vaccination was postponed on account of illness, 36 had left the town, in 48 of the cases proceedings were withdrawn, in two the parents were warned and discharged by the magistrate, and three of the children died before the date fixed for hearing in the Court. The President thinks that "in the majority of the cases prosecuted the fines were inadequate, varying "from 4 annas to 1 rupee, which did not act as a deterrent." He adds :—"The consequence is that "people do not resort to the Vaccine Depôts with their children within the period specified in the

" notices served on them, but wait till prosecution is actually instituted." According to Statement No. I., showing the particulars of vaccination, the percentage of successful cases in primary vaccination was 99·56, and in re-vaccination 86·97. As regards the high percentage of success recorded in re-vaccination, the Health Officer has been requested by the Government to examine 1,000 cases as a test of the accuracy of this record, and to report on the result obtained. At the time the Report was written the whole of the 1,000 cases had not been examined. The total number of births registered in 1897–98, including still-born, having been 18,799, when the 362 still-births and the 5,100 deaths of children under one year are deducted, 13,337 would remain available for vaccination. According to Statement No. I., 15,083 children under one year were successfully vaccinated. The number successfully vaccinated was, thus, in excess of the number born in Madras available for vaccination. This is accounted for by the fact that infants born up-country and who resided within the city for more than two months were also vaccinated under the byelaws. Of the total number of infants vaccinated during the official year, 11,300 only were born in Madras, the remaining 4,023 having been born in the country. The percentage of persons vaccinated to population was 7·31, or greatly above the birth-rate, which was 4·13. Looked at from every point of view Madras, for an Indian city, should have a well-vaccinated population. The percentage of infants vaccinated is high —81·50 of the births according to the table in paragraph 152; the percentage of vaccinations to population is high; and, best proof of all, the mortality from small-pox even in a year when the disease prevailed in epidemic form, did not exceed 0·2 per thousand of population. Owing mainly to the increased number of cases vaccinated during the year, the cost of each case fell from six annas in the previous year to five annas and one pie.

4. *Cholera* was credited with 196 deaths, or a ratio of 0·3 per thousand of population. Although above the average of the preceding four years, this mortality cannot be considered high. For the Madras Presidency the ratio was, in the case of cholera, 4·4; and in the case of small-pox 0·7 for the calendar year 1897. The mortality from cholera in Madras City was thus fourteen times less, and from small-pox three times less, than in the Madras Presidency.

5. As usual, *fevers* had a greater number of deaths attributed to them than any of the other chief diseases; but they were less fatal than during the previous year, and the death-rate due to them fell from 13·3 to 12·1 per thousand of population. The causes which favour fever prevalence are known, and " until adequate provision is made for effective drainage, the proper disposal of dead bodies and " refuse of all kinds, the supply of wholesome water and other sanitary requirements of prime " importance, any great reduction in the fever death-rate cannot be expected." If decreasing mortality may be accepted as an indication that the causes which give rise to fever are in course of being removed in Madras, the diminishing death-rate from this disease from 1892, when it was 15·2, down to the year under report, when it had fallen to 12·1, must be matter for satisfaction. As with fevers, so with *bowel complaints*, which depend for their prevalence largely on the same causes as the former, there has been a steady decrease in their fatality since 1892. Of the unhealthiness of a town there is perhaps no more sensitive gauge than its infant mortality, and measured by this Madras cannot be classed amongst healthy cities. Although the death-rate amongst infants fell from 407 of every 1,000 births in the preceding year to 369·6 in the year under report, it is still high and may safely be accepted as indicating the existence of serious defects in the hygienic conditions of the city.

6. Fortunately, although a case of plague was introduced, the disease failed to secure a permanent footing in Madras. As stated in the report, " the precautionary measures adopted against this disease " have formed an important feature of the administration " of the year, and, so far, appear to have been successful.

7. Under the heading " Sanitary Defects," a summary is given of the chief sanitary wants of the city. Drainage remains the most urgent of these, " though a beginning has been made in the right " direction by the connection of a certain number of houses in Mylapur with a sewerage system " which will discharge, *viâ* a pumping station, over a sewage farm just to the north of Mylapur." The sewage farms, it is stated in the Government review of the Report, were worked at a profit of Rs. 33,545 against Rs. 2,851 in the previous year. When practicable, there can be no more satisfactory way of disposing of sewage and other town refuse than by utilising them as fertilisers of the soil. The importance of preserving the ground within the inhabited area from pollution is forcibly put :— " The ground in such places is soaked with organic matter, and, when the ground air is forced out by " a rise in subsoil water, it is hardly surprising that the death-rate takes a leap up. Even the daily " variations of temperature give rise to great movements of the ground air." The improvement of sanitation is no doubt an up-hill task in Madras. Not only has the dead weight of native apathy and neglect to be overcome, but the labour supply difficulty is ever present in a more or less acute form. A sufficient number of scavengers cannot always be obtained, and when obtained they will only work when they choose : " there is no way of making them work if they do not wish to." The water supply will not be satisfactory until it is made continuous, instead of being, as it is at present, intermittent. If all the pipes were kept full " it would then be possible to have all the wells in the " town closed; for it is scarcely possible, infiltrated as the soil is with organic matter, for any of the " wells in populous quarters to contain water that is fit to drink."

8. Briefly, the year was healthier than the preceding one. Whilst the birth-rate remained nearly the same as in 1896, the death-rate fell from 37·8 to 35·5 *per mille* of population. The poorer classes suffered under pressure of high prices of the food grains chiefly used by them. Short rainfall between the middle of October and the end of the year doubtless contributed towards diminished mortality from malarial diseases. The decrease in the death-rate was mainly due to lessened mortality from fevers and bowel complaints. Small-pox prevailed in epidemic form, and was accountable for 114 deaths. Owing to the previous well-vaccinated state of the population, together with the vigorous prosecution of vaccination and re-vaccination during the epidemic period, the disease was held in check and the mortality did not exceed a ratio of 0·2 *per mille* of population.

There was a large increase in the number of persons vaccinated during the year, a result which is attributed to the stimulus given to vaccination by the epidemic prevalence of small-pox. The percentage of infants vaccinated was high, and equalled 81·5 of the births. Cholera was credited with a ratio of 0·3 deaths *per mille* of population in Madras City, as compared with 4·4 in the Madras Presidency. A progressive decrease in the mortality due to fevers and bowel complaints since 1892 is a satisfactory feature of the returns. Although a case of plague was introduced during the year, the disease failed to secure a footing in Madras. A summary is given of the chief sanitary defects still existing. Drainage continues to be the most important of the sanitary requirements of the City. Next in importance is the need for a continuous water supply. Until the latter is provided, the inhabitants will have to go on using well-water, which, in populous quarters, owing to the pollution of the soil in which the wells are sunk, can hardly be fit to drink.

10th August 1899.

No. 15.

Memorandum by the Army Sanitary Commission on the Administration Report of the Municipal Commissioner for the City of Bombay for the Year 1897–98.

The sanitary history of the year is practically the history of the plague epidemic, and of the measures adopted with the object of staying it. The plague, which was first definitely recognised in Bombay about the middle of September 1896, and was credited with a total of 1,936 deaths by the end of that year, prevailed with varying degrees of severity throughout the year under report. The greatest mortality recorded as due to it occurred in February, after which it steadily diminished until it reached its lowest point of fatality in June. During the latter month only 42 deaths were caused by it; but from June onwards to the end of the year it again increased in prevalence, although it was not in any of the last four months so fatal as it had been during the first four months of the year. To those who gathered their knowledge of the progress of the plague in Bombay city from the telegrams and newspaper accounts which appeared daily throughout the year, a record of only 11,003 deaths, equal to a ratio of 13·39 per thousand of the population, will seem somewhat inconsiderable in proportion to the widespread alarm which the disease excited. The accounts of the wholesale destruction of the inhabitants of cities during plague epidemics in former times no doubt led people to expect that the history of the disease would repeat itself in the case of a great and crowded eastern city like Bombay. "Even in 1897," writes Dr. Weir, "with the second recrudescence or epidemic of plague, "followed by a third recrudescence, the total mortality from all causes in Bombay was not as high as "the mortality from plague alone in many places in India."

2. The influence of the plague on the *birth-rate* was more striking than its influence on the *death-rate*. Owing partly to the great preponderance in the population of males, and partly to defective registration, a low birth-rate is a constant feature of the vital statistics of Bombay. In 1896, this rate was only 19·33 per thousand of population: in the year under report it fell to 11·36. In a population of upwards of eight hundred thousand there were only 9,336 living children born. The proportion of still-born children, always high in Bombay, was excessive in 1897. To every 100 children born alive, over 14 were still-born. Dr. Weir offers no explanation of this increase in the number of still-births. The reduction of the population, numbers following the outbreak of plague and the adoption of stringent measures with the object of staying it, would to some extent account for the remarkable decrease in the birth-rate. The exodus of the inhabitants was at one period estimated at not less than a fourth of the population of the city. Although this may have been an exaggeration, and although the fugitives by degrees returned, it is reasonable to attribute to this cause a considerable effect in reducing the birth-rate. The recorded death-rate was 58·28, as compared with 39·84 for the entire Presidency. This rate cannot be looked upon as excessive under the health conditions obtaining during the year. The loss of life caused in the Central Provinces by famine and its consequences was far greater. For the same reason, however, that the birth-rate in Bombay was abnormally low, it is probable that the death-rate is understated. The diminution of the population, already mentioned, cannot but have led to a diminution in the number of deaths in the city proportionate to the diminished population furnishing the deaths. The ratio of deaths which occurred in this diminished population is calculated, not upon the diminished population numbers, but upon the census numbers of 1891. Yet, even when allowance is made for this probable source of error, the mortality in a city of the size of Bombay during a year when plague prevailed in it from beginning to end, was less than might have been expected. To what extent plague mortality was held in check by the vigorous measures adopted by the Health Department up to the end of March, and subsequently by the Plague Committee, must be more or less a matter of conjecture; but there is no reason to doubt that, although some of these measures may not have been successful, their effect, as a whole, was sensibly to control the disease and to lessen the mortality from it.

3. The Health Officer appears to believe that some of the measures referred to had an effect the opposite of that which they were intended to produce. "There are good reasons," he states, "for "thinking that the disease might have reached its *fastigium* on the 9th of February 1898, if the "measures, as was found a month later, had been relaxed. If the concealment of cases had been less, "the epidemic would have decreased sooner, was the belief I expressed. An epidemic can be "irritated as well as a local sore, and the period between the 9th of February and the 15th of March "may be described as the period of panic and irritation. The measures were followed by the conceal-"ment of cases, and concealment led to intensification of type. The conditions existed which it

" would have been necessary to create had it been desired to intensify the disease." Dr. Weir is probably not singular in believing that, in enforcing the measures for the detection of cases of the disease, for the segregation of the plague-stricken or those suspected of having been in contact with them, for their treatment in hospitals ; and, in the event of death supervening, for the disposal of their dead bodies, a point of stringency may be reached when these measures not only defeat their purpose but create the very evils they are intended to remove. On this question no one can be in a better position to express an opinion founded on experience in dealing with plague than Dr. Weir. Elsewhere in his report he says, regarding the progress of the epidemic in 1897 :—" Though the number of " plague cases was less than in 1896, the *total* mortality was *higher*. This implied concealment of the " disease and intensification of the type through concealment. There is no better tribute to the Health " Department in 1896 than that in 1897, with a higher mortality, with an enormously greater " expenditure, and with a vast organisation, *fewer* cases of plague were at that period detected by the " Plague Committee than by the Health Department in 1896. I admit the difficulties of the Plague " Committee. The population was against them, and they had lost the assistance of the medical " profession. It was difficult for them to obtain information, for the people did not call in medical men."

4. Some of the conditions known to have favoured the development and increased the fatality of plague in other cities in the past, exist to a marked degree in Bombay. The area of the city is about 22 square miles, "and on a portion of this there is the most densely crowded population in the British " Empire." So rapid has been the growth of the city " that all the improvements that other cities " have had centuries to complete are not to be accomplished in Bombay in a few years." The valley in which most of the population live in closely built houses is considered by the Health Officer to be " most unfavourably situated " ; but this opinion does not appear to be altogether consistent with the statement which follows :—" In 1895, before the appearance of plague, Bombay was more healthy than " any large city in India, and the chances of life were better than in many European towns." Apart, however, from what may be regarded as conditions inherent in Bombay which are favourable to the development of diseases, there were others which came in with 1896, and left with 1897. The failure of the harvests, following the premature cessation of the rains in 1896, caused much distress over vast areas of India. The consequences, so far as the City of Bombay was concerned, were disastrous, " people struggled here by road from a famine area as far off as Central India. Even previous to the " monsoon some 40 per cent. of the people arriving by sea were classed by an observer as destitute " and sickly. A year of famine provides helpless subjects for epidemics. If it were decided to " select destitute persons susceptible to epidemic diseases, no groups more susceptible or less resistant " than the large number of people who trudged all the way from Central India by road, and who " arrived here either ill or very weak, could be found." Another of the conditions connected with plague prevalence seems to have great importance attached to it by the Health Officer. The future course of the plague epidemic, he thinks, depends on " the multiplication of the rat population and the disappearance of the disease from amongst rats." He adds :—" Till the rats become immune, the " disease must continue to occur amongst human beings wherever it has been epidemic." If the belief is well-founded, and it seems to be supported by much evidence, that mortality amongst rats often precedes outbreaks of plague amongst human beings, and if, further, the death of the rats is due to plague which they are capable of transmitting to human beings, no system of quarantine, or of segregation during plague prevalence, would seem likely to prove effectual if it left out of count the destruction of the rat population. If, as seems to be a matter of wide-spread belief, rats can communicate the disease to man, the risk of infection of ships, more especially, by these animals might be expected to be great. Much curious evidence is given by Dr. Weir in the sections of his Report dealing with the part which rats are supposed to play in connection with the transmission of plague. "The knowledge that *rats* are carriers of the disease is widespread, and is now being " practically made use of by the people who never had cats before, but who now keep and feed *cats*." The question has a very practical bearing on plague prevention, to judge from the following quotation from Dr. Weir's Report :—" In another portion of this Report I have referred to the " influence of house-drainage in preventing the recrudescence of plague. At first, I thought the effect " of drainage was due to the improvement of the generally sanitary condition of buildings, but I have " now come to the conclusion that it is dependent on the closing of rat-holes, and the demolition of " the homes of the rats."

5. The account given of the incidence of plague according to locality and class of the community is full of interest. One would not have expected that "a lower mortality occurred from plague in the surface-crowded portions of the city than in the suburbs." Dr. Weir believes this to be due to " ventilation " : " the chawls in which the poor classes live have often a gully on one side, and into " this gully windows open. In consequence of this there is more air circulation in the rooms in " which they live even in chawls than in the central and dark rooms in old-shaped buildings in the " suburbs, although these buildings may be in the fields or surrounded by open spaces." The influence of ventilation on plague is well shown in the table given in paragraph 112 of the Report. The proportion of deaths to attacks diminishes steadily with the height of the floor from the ground. " The chances of recovery progressively increased from the *first* floor upwards ; from 84 per cent. on " the ground floor to 45 per cent. on the fifth floor the mortality decreased ; and even the people on " the roadside, destitute though they may have been, had a better chance of recovery than those living " on the ground floor. The proportion of mortality to the height of residence indicates the great " influence of exposure to the air in preventing the spread of the disease." Elsewhere, Dr. Weir observes that plague mortality "has generally been lowest in the highest rooms of the highest buildings." From this it may be said to follow that the European community suffered least, because they live in the best ventilated buildings. Amongst Europeans, only 20 deaths were registered from plague ; yet they "not only did not flee the city at any time, but many of them approached the " disease and exposed themselves to contagion in aid of the sick." Next to Europeans, the lowest mortality occurred amongst Mussalmans—5·4 per 1,000. " This cannot be accepted as correct, though " the Mussalman population suffered *less* than many other classes." The highest mortality occurred amongst the Hindu low castes. By class, the mortality fluctuated between 1·7 per 1,000 for Europeans, and 23·9 for low-class Hindus.

6. Regarding the vexed question of the removal of the plague-stricken to hospitals, Dr. Weir gives his views in the following words :—" In the report on plague in 1896 I held that the treatment of the " sick might be modified according to (*a*) the type of the disease, and (*b*) the ventilation of buildings. " I believe the correctness of this view has been established by experience. I can see no reason why " patients ill from plague should not be treated inside the verandahs of buildings when the verandahs " are wide and look on to open spaces, or why in the fair weather, when there is open space outside " buildings, awnings should not be put and patients allowed to be placed under them. There is no " use in evading the fact that the patients would be better placed for themselves and of no more " danger to others under these conditions than in many private hospitals."

7. The other diseases which, next to plague, contributed most to the mortality of the year in Bombay were diseases of the respiratory system, fevers and phthisis. From *small-pox* there were only 57 deaths, or a ratio of ·07 per thousand of population. During a year when the combat with plague might have been expected to monopolise the energies of almost every department, some falling-off in vaccination would not have been surprising. This, however, was not the case. The returns show that 9,765 children under one year of age were successfully vaccinated, whilst only 9,336 live births were registered. In addition, 2,027 children under six years of age were successfully vaccinated and 136 persons over six years. Of re-vaccination there were 469 successful cases against 314 failures.

8. *Cholera* was credited with 1,265 deaths, or 775 more than in 1896 and 1,001 more than the average. The conditions under which it prevailed were not unusual, and were those which Dr. Weir has repeatedly described as accompanying it in Bombay city. According to months of greatest prevalence, it took the same course as in 1896. Its history during the year further confirms Dr. Weir's observation that people living on ground floors suffer much more severely from cholera than those living in upper stories. Of 1,480 cases, as many as 879, or more than 59·39 per cent., occurred on the ground floors. The explanation, Dr. Weir believes to be, " the development of cholera " germs in the muddy or damp ground, or in dwellings around, and the greater exposure of people " sleeping on the ground floor to them." The highest mortality occurred amongst low caste Hindus and Native Christians; and it is notable, as the Health Officer remarks, that the classes who suffered most are probably the classes most careless about their food and water. The disease was also much less fatal amongst the permament population than amongst immigrants. " The mortality according to " place of birth, both last year and this year, shows that a permanent population live under conditions " much more favourable than the masses who come here to sojourn and labour can hope for."

9. Notwithstanding the epidemic of plague, the work of the Health Department was never once interrupted throughout the year. The works for the removal of refuse outside the island of Bombay have been commenced, and " one great danger to the public health will be removed with the removal of the refuse." Progress has been made in the construction of open drains and house connections. The year is described as having been one of distinct progress in house sanitation. Great improvements have been made in house drainage and great improvements in house ventilation. In such a year the expenditure of the Health Department was necessarily enormous. The special sanitary measures in connection with the outbreak of plague alone cost close upon six lakhs of rupees.

10. Briefly, the year was one of pestilence and famine. Plague, which was first recognised in Bombay about the middle of September of the preceding year, continued with varying degrees of severity throughout 1897. Taking into account the size of the city and the nature and density of its population, 11,003 deaths, giving a ratio per thousand of population of 13·39 from plague alone, can hardly be looked upon as very excessive. The Health Officer shows that nothing had a more marked influence on plague than ventilation. Plague mortality varied in accordance with the sufficiency or insufficiency of the ventilation. Europeans, who live in the best ventilated houses, suffered little compared with the other classes of the population, although they not only did not flee the city during the epidemic, but even visited and attended to the needs of those suffering from the disease. The part which rats take in the dissemination of plague would seem to be a question of much importance. If they are carriers of infection, measures adopted for the prevention of the spread of plague, to be effectual, would have to include extermination of rats. The removal of the plague-stricken from their homes to hospitals is not considered by the Health Officer to be generally either necessary or expedient when suitable accommodation is available in the verandahs of their dwellings. Small-pox was in abeyance during the year, and was accountable for only 57 deaths. Cholera was more fatal than usual; but, considering that Bombay was inundated with ill-fed immigrants from famine-stricken districts, 1,265 deaths from it cannot be regarded as a very large number. Next to plague, the diseases which were most fatal were respiratory diseases, fevers, and phthisis. Whilst the death-rate from all causes rose to 58·28, the birth-rate at the same time fell to only 11·36 per thousand of the population. Notwithstanding the epidemic of plague, the work of the Health Department was never once interrupted. Many and important sanitary improvements were carried out during the year.

10th August, 1899.

REPORT

ON

SANITARY MEASURES IN INDIA

IN

1898-99.

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BOMBAY BRANCH
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REPORT

ON

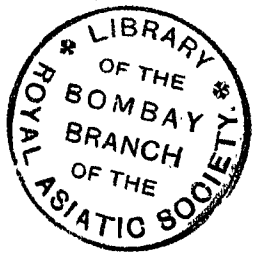
SANITARY MEASURES IN INDIA

IN

1898-99.

VOL. XXXII.

Presented to both Houses of Parliament by Command of Her Majesty.



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A. GODLEY,
Under Secretary of State for India

INDIA OFFICE,
October, 1900.

REPORT.

The present Report on Sanitary Measures in India during the year 1898 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population ; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1898.

The health of the European troops on service in India in 1898 was much better than in the previous year, though the death-rate was higher than the average (15·16) for the ten years 1886-95. On an average strength of 67,741, the admissions into hospital were in the ratio of 1,437 per 1,000, against 1,557 in 1897, the daily sick-rate fell from 101 to 90, and the death-rate from 22·93 to 20·05. The invaliding ratio (38) was higher by 5 per 1,000, so that the total loss by death and invaliding was equal to 58 per 1,000, an increase of 2 per 1,000 on the previous year.

The Presidential Army system was abolished in 1894, and the whole of the force in India is now designated the Army of India, divided into the Bengal, Punjab, Madras, and Bombay Commands. This organization took effect from the 1st April 1897.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands during 1898 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1898	20,060	1,484	96	19·54	44	64
	1897	20,113	1,619	113	23·32	41	64
Punjab	1898	18,388	1,558	90	27·63	40	68
	1897	17,190	1,460	93	21·52	22	44
Madras	1898	12,337	1,293	89	8·59	44	53
	1897	12,369	1,354	104	13·10	48	61
Bombay ...	1898	14,612	1,420	86	18·20	29	47
	1897	14,859	1,508	92	14·33	32	46
INDIA ...	1898	67,741	1,437	90	20·05	38	58
	1897	68,395	1,557	101	22·93	33	56

It will be seen from the above statement that of the four Commands Bengal had the highest daily sick-rate and the Punjab the highest death-rate. The Madras Command was again the healthiest, and its death-rate was less than a third that of the Punjab.

The chief causes of sickness in the whole European Army were, as in the year 1897, ague and venereal diseases, the former yielding a ratio of 394 per 1,000 against 395 in 1897, and the latter 363 per 1,000 against 486. More than half (52 per cent.) of the total sickness resulted from these two causes. Enteric fever, as usual, was the chief cause of mortality, and the death-rate from it was 10·17 per 1,000 against 9·01 in 1897. This fever yielded over 51 per cent. of the total deaths.

Groups of stations.

The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,226	1,168	86	4·08
Burma, Inland	2,654	1,197	79	7·54
Bengal and Orissa	2,381	1,445	81	14·70
Gangetic Plain and Chutia-Nagpur	6,686	1,426	102	21·09
Upper Sub-Himalayan	12,751	1,622	95	22·82
North-Western Frontier, Indus Valley, and North-Western Rajputana.	4,737	1,890	95	32·09
South-Eastern Rajputana, Central India, and Gujarat.	6,011	1,612	99	22·13
Deccan	8,256	1,447	98	11·75
Western Coast	1,522	1,093	83	11·17
Southern India	3,520	1,488	87	11·08
Hill Stations	7,625	1,139	78	20·46
Hill Convalescent Depôts	3,160	1,433	96	13·61

Of the above 12 groups, six returned a higher daily sick-rate than the ratio for the whole European Army, the highest being 102 per 1,000 of average strength in the Gangetic Plain and Chutia-Nagpur group, the South-Eastern Rajputana, Central India, and Gujarat group following with a ratio of 99. The lowest ratio (78) was returned by the Hill Stations group. The death-rate of the entire Army was exceeded by five groups, viz., the North-Western Frontier, Indus Valley, and North-Western Rajputana; Upper Sub-Himalayan; South-Eastern Rajputana, &c.; the Gangetic Plain and Chutia-Nagpur; and Hill Stations.

Of the stations with a strength of over 1,000, five returned death-rates above 20 per 1,000, viz., Peshawar 48·95, Quetta 44·43, Lucknow 30·66, Umballa 26·90, Agra 23·39, and Rawalpindi 20·21.

lera. There was very little cholera in the European Army in 1898. The admissions to hospital from the disease numbered only 17 or 0·3 per 1,000 of average strength, against 117 or 1·7 per 1,000 in 1897, and the deaths fell from 80 or 1·17 per 1,000 to 14 or 0·21. Of the 17 cases Umballa station contributed 10, all being fatal.

ll-pox. Among the whole of the European troops in India there were during the year under notice only 2 cases of small-pox with no death. In the previous year there were 24 cases and four deaths.

rs. From intermittent fever the admissions to hospital among the European troops in 1898 were in the ratio of 394 per 1,000 of strength, identically the same (395) as in the previous year. The death-rate, however, was much lower, viz., 0·30 per 1,000, against 0·41 in 1897.

From enteric fever the admissions rose from 2,214 or 32·4 per 1,000 of strength to 2,498 or 36·9, and the deaths from 616 or 9·01 per 1,000 to 689 or 10·17. Of the four Commands Punjab recorded the highest mortality under this head, viz., 14·74, followed by Bengal with a ratio of 10·47, Bombay 9·92, and Madras 2·27. Among the larger stations with an average strength of over 1,000, Quetta returned a death-rate from this fever of 35·08, Peshawar 24·48, Lucknow 22·57, Agra 16·71, Allahabad 16·03, Umballa 13·19, Mhow 12·01, and Rawalpindi 10·95. As usual, young and unacclimatised soldiers were the chief sufferers; among those from 20 to 25 years of age the death-rate was 13·46 per 1,000, against 12·74 in 1897, while among men between 25 and 30, and from 30 to 34, the mortality was 2·77 and 2·83 per 1,000 respectively. Among

men of less than one year's residence in India the death-rate from this fever was 20·43 per 1,000, among men between one and two years 9·63, and among men between five and ten years' service the rate was 3·72 per 1,000. Of the total, 689 deaths from enteric fever, 74 per cent. occurred among men between the ages of 20–25, and 41 per cent. during the first year of residence in India.

Bowel complaints.

The admissions from dysentery and diarrhœa among the European troops were in the ratio of 57 per 1,000 of strength, or 22 per 1,000 less than in 1897. The mortality from dysentery was in the ratio of 0·78 against 2·53 in the previous year, and from diarrhœa 0·04 against 0·23. Dysentery was most prevalent in the Bengal Command.

Abscess of the liver.

From abscess of the liver there were 102 deaths, yielding a ratio of 1·52 per 1,000 of strength, against 1·29 in 1897.

Plague.

There were nine cases of plague among the European troops in 1898, and two of them were fatal.

Venereal diseases.

Venereal diseases ranked second in the list of causes of admission to hospital; and first in the causes of invaliding. They were the cause of 25 per cent. of the total sickness during 1898, and over 22 per cent. of the invaliding of the European Army of India. The ratio of admissions from venereal diseases per 1,000 of strength was 362·9 or 123 per 1,000 below that of 1897. Regarding this reduction, Dr. Harvey, Sanitary Commissioner with the Government of India, states—"From the reports of medical officers, it appears that this decrease was partly unreal, and due to the widespread adoption of the system of treating venereally-affected men as out-patients; and partly real, and due to the introduction of continuous and more prolonged treatment of the sick, to measures adopted under the new cantonment rules, to the placing of certain bazaars and cities out of bounds on account of the plague, and to the employment of a certain number of men on field service." The admission-rate from venereal diseases was highest in the Madras Command, viz., 438·3 per 1,000, Bengal came next with a ratio of 437·9, Bombay with 352·5, and the Punjab with 268·9, all being lower than in 1897. The number of men constantly sick in hospital from these diseases was 2,202, against 2,992 in the previous year, being equivalent to over two regiments; and the average stay of a case in hospital was 33 days. The deaths from these diseases numbered 17, and the invalidings 569, against 23 and 662 respectively in 1897.

Invaliding

The loss to the whole army by invaliding during 1898 amounted to 2,580 men, equal to 38·09 per 1,000, against 2,258 or 33·01 in 1897. The proportion of invalids to strength was highest in the Madras Command (43·9), followed by Bengal (43·5), Punjab (40·1), and Bombay (29·2). Of the total number invalided, 28 per cent. were discharged as unfit for further service, being 6 per 1,000 lower than in 1897. As regards the influence of age and length of residence in India upon invaliding, 62 per cent. of the total number invalided were under 25 years of age, against 63 in 1897, while 33 per cent. were of less than two years' service, and 83 per cent. were of less than five years' service. In the European Army as a whole 82 per cent. of the total strength had seen less than five years' service.

II.—NATIVE ARMY.

The health of the Native Army of India was also better than in 1897, notwithstanding an increase of influenza and respiratory diseases among the troops.

The ratios of sickness and mortality among Native troops in the six Commands during 1898 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1898	25,036	767	35	10·03
	1897	26,644	834	33	9·12
Punjab	1898	42,515	942	35	13·38
	1897	35,454	867	31	13·26
Madras	1898	22,575	683	30	9·92
	1897	23,588	710	32	9·45
Bombay	1898	24,520	870	31	7·79
	1897	26,421	822	27	10·48
Hyderabad Contingent	1898	6,304	474	17	5·08
	1897	6,554	551	19	6·26
INDIA	1898	126,036	816	33	11·07
	1897	129,802	839	31	13·12

Of the five Commands the Punjab again returned the highest rate of mortality. The ratio being also slightly higher than that for 1897. Pneumonia was very prevalent in this force, and the death-rate from it was 6·52 per 1,000, or nearly a half of the total mortality.

The chief cause of sickness in the Native Army was ague, which again caused 41 per cent. of the total admissions. Among the diseases from which the admissions to hospital were higher than in 1897 were influenza, remittent fever, respiratory diseases, and tubercle of the lungs ; while from small-pox, scurvy, cholera, and ague there was a decrease in the admissions. From influenza the admission-rate rose from 5·4 per 1,000 of average strength in 1897 to 8·3. From venereal diseases the admission-rate in the Native Army was only 40·0 per 1,000 of strength, as compared with 362·9 per 1,000 among European troops. Figures under this head are not available for the years before 1877. The ratios run at a much lower level than those of European troops, and only three times since 1877 has the admission-rate reached 40 per 1,000, viz., in 1890 when the ratio was 41·1, in 1897 when it was 40·8, and in the year under notice.

Pneumonia was the chief cause of death in the Native Army, and no less than 34 per cent. of the total deaths were due to it. The death-rate under this head was 3·77 per 1,000 of average strength, against 2·73 in 1897. From this disease the mortality among the Native soldiers was six times as great as that among European troops (0·61 per 1,000). Fevers of all kinds were the cause of 16·4 per cent. of the total deaths, against 54·3 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 1·69 per 1,000, while among the European troops the proportion was 0·73. On the other hand, the death-rate from enteric fever among the Native troops was only 0·13 per 1,000, as compared with 10·17 among the European troops. From cholera there were 42 deaths in the Native Army, equal to 0·33 per 1,000 of strength, as compared with 68 or 0·52 in 1897.

During 1898 there were 94 cases of plague among the Native troops with 58 deaths, against 131 cases and 81 deaths in 1897.

The following statement gives the principal statistics of the Native Army, arranged in geographical groups, for 1898 :— Groups of stations.

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,391	650	26	5·03
Burma, Inland	4,389	952	36	8·89
Assam	1,547	876	40	27·15
Bengal and Orissa	2,905	1,038	40	9·98
Gangetic Plain and Chutia-Nagpur	5,620	695	34	4·98
Upper Sub-Himalayan	13,857	802	32	10·39
North-Western Frontier, Indus Valley, and North-Western Rajputana.	15,492	1,120	39	15·75
South-Eastern Rajputana, Central India, and Gujarat.	11,310	692	26	7·25
Deccan	18,428	689	27	6·29
Western Coast	2,796	775	36	12·88
Southern India	7,920	635	33	12·37
Hill Stations	18,913	1,149	45	14·06

In eight of the 12 groups the daily sick-rate was higher than that for the whole Native Army, and in five the mortality was greater. The highest mortality was that of the Assam group (27·15), which shows an increase of 14·3 per 1,000 on the rate for the previous year. This was mainly due to cholera, the death-rate from which was 8·4 against *nil* in 1897.

Of the large stations with a strength of over 1,000, the following recorded the highest death-rates :—Edwardesabad 40·61, Datta Khel 40·32, Dharmsala 24·33, and Meerut 23·87. The chief cause of death at the two first was pneumonia, and at Dharmsala pneumonia and tubercle of the lungs.

III.—GENERAL POPULATION.

The year 1898 was a fairly normal one from a health point of view. The weather was quieter and more settled than usual throughout the whole year, and in most months was drier than the average. The monsoon commenced rather late, but extended rapidly over the country, and gave more rain than usual to the greater part of India, the only regions of any marked deficiency being parts of the Punjab, Rajputana, and Berar.

Births were registered throughout all the 10 provinces in India in 1898, and the birth-rates varied between 41·0 and 16·1 per 1,000 of population under registration. The best results were obtained in the Punjab, the North-Western Provinces and Oudh, Bengal, Lower Burma, Berar, and Bombay, their respective rates being 41·0, 37·3 35·8, 34·1, 31·3, and 30·9. In the remaining provinces the birth-rates ranged between 29·5 in Assam and 16·1 in Coorg. The North-Western Provinces, Central Provinces, and Lower Burma were the only provinces which recorded a higher birth-rate than in the previous year. The birth-rates, however, exceeded the death-rates in all the provinces except Assam and Coorg, the excess per 1,000 varying between 10·0 in the North-Western Provinces and the Punjab and 1·8 in Bombay. The recorded deaths fell from 7,645,257 or 36·03 per 1,000 of registered population in 1897 to 5,676,833 or 26·56. The decrease in mortality was due to the less prevalence of all the chief diseases, especially of cholera and fever. In all ten provinces the mortality was lower than in the previous year. Cholera deaths fell from 550,768 to 151,509, and the decrease was spread over all the provinces. Only two provinces recorded cholera death-rates of over 1 per 1,000, viz., Assam 2·2 and Madras 2·0. The diminution in the deaths from fevers by 1,155,178 was participated in by all the provinces except Madras and Lower Burma. In connexion with this cause of death the scheme for the sale of quinine at a low price by postal agency continued to be appreciated by the people. In some places, however, there was a falling off in the demand, which was most likely due to the exceptional healthiness of the year.

The deaths from the chief diseases and from all causes in the several provinces were as follows :—

	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1898.	1897.
Bengal	65,020	0·91	14,269	0·20	1,419,483	19·97	37,155	0·52	1,838,468	26·57	32·94
North-Western Provinces and Oudh.	2,508	0·05	2,419	0·05	1,063,596	22·67	23,574	0·50	1,284,319	27·38	40·46
Punjab	33	—	4,998	0·24	418,206	20·35	15,747	0·77	638,124	31·05	31·05
Central Provinces	7	—	1,149	0·11	164,999	15·68	13,038	1·24	246,360	24·30	69·34
Lower Burma	2,972	0·66	4,826	1·07	53,697	11·90	8,032	1·78	117,856	26·13	26·26
Coorg	8	0·05	22	0·13	4,676	27·02	189	1·09	5,440	31·44	50·03
Assam	11,149	2·22	5,199	1·03	104,963	20·90	16,239	3·23	181,527	36·15	50·61
Madras	65,444	2·0	20,490	0·6	248,638	7·5	29,654	0·9	699,108	21·0	25·4
Bombay	4,368	0·23	1,834	0·10	302,515	16·07	56,789	3·02	548,825	29·16	39·84
Berar	—	—	592	0·2	32,789	11·5	9,942	3·5	66,806	23·4	52·6
Total	151,509	0·79	55,798	0·26	3,813,562	17·84	210,359	0·98	5,676,833	26·56	36·03

The year 1898 in Bengal was exceptionally healthy. The number of births registered in the province fell from 2,625,844 or 36·94 per 1,000 of population in 1897 to 2,543,701 or 35·79, the latter being made up of district rates varying from 43·59 in Murshidabad to 26·87 in Hooghly and 13·98 in Calcutta. The decrease in the provincial birth-rate, Dr. Dyson, the Sanitary Commissioner, attributes chiefly to the effects of the late famine, and the high prices of food-grains during 1897. He says, the number of births was everywhere considerably higher during the last five months of the year 1898 than during the

earlier months. Of the 46 districts there was an increase of births in 13, the greatest advance being in Champaran, where the ratio was 5·41 per 1,000 in excess of the previous year. Only 10 districts returned a birth-rate of 40 per 1,000 and over, the highest, as already stated, being 43·59 in Murshidabad. Calcutta, as usual, occupied the last place with a birth-rate of 13·98, "and must continue to do so," Dr. Dyson remarks, "as long as the disproportion in the sexes of its inhabitants exists, there being 446,346 males and only 234,814 females." It is also stated that a considerable portion of the female population left Calcutta during the plague scare. Only four towns returned a birth-rate in excess of 40 per 1,000, while 12 rural areas recorded rates of over 50 per 1,000, and 38 others over 45 per 1,000.

The total number of deaths registered during the year under notice was 1,888,468 or 26·57 per 1,000, as compared with 2,341,632 or 32·94 in 1897. There was thus an excess of births over deaths of 655,233 or 9·22 per 1,000. The district death-rates ranged from 40·99 in Noakhali to 15·33 in Sonthal Parganas. In urban areas the rate of mortality fell from 35·09 to 27·50, which was made up of ratios varying from 52·84 in Garulia to 9·98 in Maniktola, both towns being in the 24-Parganas district. In rural areas the death-rate fell from 32·83 to 26·52. The great fall in the death-rate was mainly due to the general healthiness of the year, and improvement in the prices of food which enabled the masses of the people to be better fed and thus to resist disease more successfully.

From all the principal diseases the mortality was much less than in 1897. The province was remarkably free from cholera, the deaths having fallen from 196,247 or 2·76 per 1,000 to 65,020 or 0·91, which was the lowest death-rate from the disease ever recorded in Bengal. Cholera was, however, present in every district except Palamau, and attacked 11,307 villages against 29,776 in the previous year. Of individual districts the mortality was highest in Chittagong (7·92 per 1,000), followed by Balasore (3·15), while Puri, where the congregation of pilgrims usually gives rise to a high death-rate, was comparatively free, its ratio being only 0·45 against 9·57 in 1897. As regards the seasonal incidence of the disease in each of the main geographical divisions of the province, the mortality from cholera in Bengal and Orissa was highest in the first five months and the last month of the year. In Bihar the intensity was greatest in April and May, while Chota Nagpur was remarkably free throughout the year, the death-rate never exceeding 0·02 in any month.

From small-pox the deaths fell from 19,655 or 0·27 per 1,000 in 1897 to 14,269 or 0·20 in 1898. The disease was present in all the districts except Jalpaiguri, but the only district in which it can be said to have prevailed in an epidemic form is Puri, which returned by far the highest mortality (5·82), and where the disease is believed to be fostered by inoculation. In no other district did the death-rate under this head reach 1 per 1,000.

About three-fourths of the total deaths were recorded under fever. The mortality from this cause was, however, much below that of 1897, and less than the mean of the past decade. The number of deaths reported to have occurred from fever during the year was 1,419,483 or 19·97 per 1,000 of population, against 1,679,132 or 23·62 in 1897. Out of the 46 districts, 20 recorded a higher fever mortality than the provincial rate, four registering a rate of over 30 per 1,000, Noakhali coming first with a rate of 35·16, followed by Dinajpur 33·43 and Rajshahi and Jalpaiguri each 31·16, all of which, except the last, showed an increase on the previous year's figures. A high fever death-rate in each of these districts is, however, constant, and the only special factor noted was in the case of Rajshahi where waves of unhealthiness of the nature of influenza passed over the district in March, August, and October.

From dysentery and diarrhœa 37,155 deaths were registered, equal to 0·52 per 1,000 of population, against 53,822 or 0·75 in the previous year. "The large falling off in the mortality was evidently due," Dr. Dyson observes, "to the plentiful outturn of crops almost everywhere during 1897, which enabled the people to obtain wholesome food." Almost all the districts that were affected by the famine showed a smaller mortality under this head during the year under notice.

In Calcutta the birth-rate was, as already stated, considerably below that of 1897, viz., 13·98 against 18·46. The year 1898 was a healthy one, and in spite of an outbreak of plague which accounted for 192 deaths, the mortality was much below the average. The registered deaths numbered 20,343 or 29·8 per 1,000 of population, against 24,665 or 36·18 in the previous year. There was a decrease in mortality under all the chief death causes except dysentery and diarrhœa, from which the deaths rose from 2,896 to 3,074. Cholera deaths fell from 2,349 to 665, being the lowest number recorded since the

amalgamation of the suburbs with the town of Calcutta in 1891. There were 85 deaths from small-pox, as compared with 161 in 1897. The deaths from fever fell from 9,619 or 14·0 per 1,000 to 6,160 or 8·8.

North-Western Provinces and Oudh.

There was a great improvement in the public health of the North-Western Provinces and Oudh in 1898. The effects of the late famine had passed away, and there was an unusual absence of epidemic diseases. During the year 1,751,725 births were recorded, being equal to 37·35 per 1000, against 1,458,947 or 31·10 in the previous year. For the first half of the year the birth-rate was very low, but from July onward it rose by leaps and bounds; "and the fact would appear to testify in a remarkable manner," the Sanitary Commissioner, Dr. Thomson, states, "to the rapidity and completeness with which the population of these provinces had recovered from the distress and privation of the past years." Of the total 48 districts 23 showed a birth-rate above and 25 below the average of the provinces. Bulandshahr again headed the districts with a birth-rate of 53·93, followed by Etah 50·48, Budaun 49·26, Almora 47·20, Muzaffarnagar 47·13, Aligarh 47·06, Basti 46·07, and Kheri 45·27. The birth-rate in municipalities was 36·44, against 34·77 in the previous year, and was made up of extremes ranging from 57·32 in Sikandarabad to 7·41 in Mussoorie.

The number of deaths registered was 1,284,319 or 27·38 per 1,000 of population, against 1,897,592 or 40·46 in 1897. There were thus 613,273 fewer deaths recorded than in 1897, or a decrease of 32 per cent. The provincial death-rate, which was made up of district rates ranging from 41·59 in Naini Tal to 19·11 in Gorakhpur, was exceeded in 26 districts. The urban death-rate was 33·41 against 48·55 in 1897. Out of 104 municipalities only 31 recorded more deaths than births. Registration was again tested by local authorities, and the results disclosed an omission of 2·97 per cent. on 202,982 births, and 2·61 on 166,807 deaths; and in cases tested by the Vaccination Department the omitted percentages were 0·87 of births and 0·53 of deaths.

Cholera was much less prevalent than in 1897. The total deaths from the disease numbered only 2,508 or 0·05 per 1,000, which is the lowest mortality since the introduction of trustworthy registration in 1871. In the previous year there were 44,208 deaths, equal to a ratio of 0·94. There were no excessive ratios, and six districts were entirely free from the disease. Fyzabad recorded the highest district rate of 0·43, followed by Bara Banki 0·39. There were no serious outbreaks of the disease in any of the larger towns or at any of the annual fairs, and only 516 villages out of a total of 107,132 were affected. The mortality was lightest in March (52 deaths), and heaviest in October (503) and November (595). The disease again declined in December, when only 238 cholera deaths were reported.

The province was remarkably free from small-pox, and the mortality fell from 87,127 or 1·86 per 1,000 in 1897 to 2,419 or 0·05, which is the lowest rate recorded since 1871, except in 1895, when it was 0·04. No high rates were reported in the districts, and sixteen escaped the disease altogether. Azamgarh headed the districts with 0·22, and among towns Mau came first with 9·97.

The mortality from fever in 1898 was considerably less than in the previous year, the number of deaths having fallen from 1,463,716 or 31·21 per 1,000 to 1,063,596 or 22·67. This shows a decrease of 400,120 or 27·3 per cent. Among the districts, Naini Tal came first with a fever death-rate of 39·19, followed by Bareilly 37·61, Pilibhit 34·2, Saharanpur 33·02, Bulandshahr 32·90, and Mainpuri 32·11. Fifteen other districts recorded ratios above the provincial rate. The mortality reached its maximum in October and the minimum was in February. Dr. Thomson states that the course of the disease was normal and presented no peculiar features.

The deaths from dysentery and diarrhœa during 1898 numbered 23,574, a decrease of 35,248 on the mortality of the previous year, the death-rates being 0·50 and 1·25 respectively. Among districts, Garhwal again recorded the highest ratio of 6·92, followed by Dehra Dun 2·94 and Benares 2·30. In 12 other districts the provincial rate was exceeded.

The provinces were visited by plague during the year. The first case occurred in Jawalapur, a town near Hardwar, on the 9th January. The disease spread rapidly. A gradual evacuation of nearly the whole town was enforced, and a thorough cleansing and disinfecting process carried out, with the result that the disease ceased and re-occupation was permitted in May. A few villages outside Hardwar were also affected.

njab.

The year 1898 in the Punjab was again a healthy one. The number of births registered was 841,869 or 41·0 per 1,000 of population, as compared with 874,623 or 42·6 in 1897. The birth-rate was again higher than that of any other province in India, and was made up of district ratios ranging from 53·8 in Gujranwala and 53·4 in Jhang

to 21·8 in Simla, and 29·8 in Peshawar. In 14 districts the birth-rate exceeded the provincial rate, and 15 other districts recorded ratios between 30 and 40 per 1,000. The provincial birth-rate exceeded the death-rate by 10·0 per 1,000 of population; in six districts the excess was over 15 per 1,000; in 13 by between 10 and 15, and in the rest except Dera Ismail Khan, where the deaths exceeded the births, by less than 10 per 1,000.

From all causes 638,124 deaths were registered during the year, or only 103 more than in 1897, and the death-rate for the two years was the same, viz., 31·05. The highest district rates were reported from Dera Ismail Khan 40·11, Jhang 39·39, Karnal 37·92, Gujranwala 36·85, and Gurgaon 36·53; the remainder varied between 33·91 in Amritsar and 21·27 in Montgomery. With the exception of the outbreak of plague noticed below, no disease of an unusual character prevailed. As regards epidemic diseases, the year under notice was better than the average for ten years.

The province was practically free from cholera, only 33 deaths having been recorded as compared with 622 in 1897. Only two districts were affected, viz., Umballa and Gurgaon. The former returned 31 deaths, of which the cantonment contributed 30. "That the disease should have appeared in," the Army Sanitary Commission observe, "and restricted its spread almost exclusively to, a military cantonment, with its elaborate system of sanitation carefully carried out under expert supervision, seems a little remarkable, and is yet another proof that there is still a good deal in the behaviour of cholera, especially with regard to the conditions which determine its selection of a locality for its operations, in need of being cleared up."

The severe epidemic of small-pox which visited the province in 1896 and caused a mortality of 45,084 and a death-rate of 2·19, which was the highest reached in any year since 1879, diminished in the following year to 16,077 or 0·78, and further declined in 1898 to 4,998 or 0·24. All the districts were affected except Simla, but the disease was most fatal in Umballa, with a death-rate of 1·07 per 1,000, followed by Sialkot, with a ratio of 0·56 per 1,000, and by Kohat with 0·52. Of the total 4,998 deaths from this disease, all but 487 were children between the ages of 1 and 12.

The mortality from fevers was slightly less than in 1897, though it was as usual severe. The deaths numbered 418,206, giving a death-rate of 20·35 per 1,000, against 422,826 or 20·57 in 1897. The provincial rate was exceeded by 14 out of the total 31 districts, the highest being Dera Ismail Khan 32·26, Bannu 27·99, Gujranwala 26·97, Muzaffargarh 26·29, Gurgaon 26·03, Karnal 25·06, Kohat 24·86, and Dera Ghazi Khan 24·26.

From dysentery and diarrhœa 15,747 deaths were registered, or 104 less than in 1897, the death-rate being 0·77 in both years. Eleven districts recorded a higher mortality under this head than the provincial rate, the highest being Simla 1·93, Gurdaspur 1·71, Gurgaon 1·37, Delhi 1·16, and Hoshiarpur 1·10.

Plague appeared in the province in an epidemic form during the year 1897, when 175 deaths were recorded in Jullundur district. In 1898 there were 1,951 deaths from the disease registered, and of these Jullundur contributed 1,563, and Hoshiarpur district 388.

Central Provinces.

The year 1898 is reported to have been the healthiest which the Central Provinces have known during the past quarter of a century. The recovery of the people from the effects of the famine is shown in the increased number of births registered during the year, which aggregated 284,176 or 29·91 per 1,000 of population, against 254,973 or 26·83 in 1897. The increase was distributed over 14 of the 20 districts, the exceptions being Betul, Nagpur, Wardha, Chanda, Nimar, and Burhanpur; and in all the districts but two (Saugor and Damoh) there was an excess of births over deaths. In the previous year, when famine prevailed, there was an excess of deaths over births in all districts except Sambalpur, which was not affected by scarcity or famine at any time. By districts the birth-rates ranged from 45·54 in Nimar and 45·43 in Sambalpur to 22·18 in Saugor. The provincial birth-rate was exceeded in six districts.

The deaths during the year numbered 246,360 or 24·30 per 1,000, against 658,907 or 69·34 in 1897. The mortality in 1897, however, was abnormal and was in great part due to widespread and destructive epidemics of cholera and fever. Still the mortality in 1898 was very low, and fewer deaths were registered than in any other year on record. The provincial death-rate was exceeded in eight districts, with ratios varying between 34·22 and 24·31; in the remaining 12 districts the death-rates ranged from 24·27 to 19·72.

From cholera only seven deaths were recorded during the year, one in Saugor, four in Balaghat, and two in Nagpur, as compared with 57,131 or 6·01 per 1,000 in 1897. "The complete cessation of the epidemics of the two previous years," the Sanitary Commissioner, Dr. Hutcheson, writes, "was very remarkable. The year 1898 coincides with the

quadrennial or quinquennial disappearance of epidemic cholera in the Central Provinces as in 1884–1888–1893. The general physical and other laws which dominate epidemics indicate a cycle in epidemic occurrences."

Small-pox was also considerably less prevalent than in the previous year, and the deaths fell rom 3,647 or 0·38 per 1,000 in 1897 to 1,149 or 0·11. The disease, however, affected every district but four—(Murwara Jubbulpore, Burhanpur, and Mandla),—but in no district did the death-rate reach 1 per 1,000, the highest being 0·49 in Sambalpur. Of the total small-pox deaths 218 occurred among infants and 386 among children under 10 years of age.

The deaths ascribed to fevers numbered 164,999 or 15·68 per 1,000 of population, against 389,335 or 40·08 in 1897. The number of deaths and the death-rate were both much less than in any of the previous years from 1891. The provincial death-rate from fever was exceeded by thirteen districts, with ratios of mortality ranging from 30·01 to 15·81.

From dysentery and diarrhœa the registered mortality fell from 81,092 or 8·53 per 1,000 of population in 1897 to 13,038 or 1·24, the marked decrease being due to the complete disappearance of famine and privation from amongst the people. The lowest death-rate under this head was recorded by Bhandara district (0·15), and the highest by Sambalpur (2·89).

Plague made its appearance in the province, but from the time of the outbreak of the disease in Bombay in September 1896 to October 1898 there were only 16 deaths, all being imported cases. Precautionary measures were adopted to prevent it spreading; it appeared, however, in an epidemic form in the town of Hinganghat in November 1898, afterwards extending to Wardha and several villages in Wardha district, also to the towns of Nagpur and Bhandara before the close of the year, by which time 128 more deaths had been recorded.

Registration of vital statistics is making steady progress in Burma. Births and deaths continued to be recorded in Lower Burma and registration was extended to three more municipal towns in Upper Burma, making 12 towns in all in which full statistics are recorded. Arrangements were completed for introducing the system of registering deaths in selected districts in Upper Burma from the beginning of 1899. In the area under registration in Lower Burma 153,838 births were recorded in 1898, giving a birth-rate of 34·11 per 1,000 of population, as compared with 143,659 or 31·82 in 1897. That there is still much room for improvement is shown in the variations in the district rates, which ranged from 45·24 in Myaungmya to 18·77 in Rangoon. The number of deaths registered was 117,856, giving a death-rate of 26·13 per 1,000 of population, against 118,570 or 26·26 in 1897. By districts the ratios ranged from 18·40 in Mergui to 43·39 in Rangoon.

Of the chief causes of mortality, cholera was much less prevalent than in 1897, and the number of deaths fell from 8,538 or 1·89 per 1,000 to 2,972 or 0·66. All the districts were visited by the disease except Mergui, and only 8 and 12 deaths were reported in the Tavoy and Sandoway districts. Cholera was present throughout the year, the months of greatest mortality being April, May, July, and March. In both years the disease took a downward course from July until December.

Small-pox was considerably more fatal than in 1897, the deaths having risen from 1,950 or 0·43 per 1,000 to 4,826 or 1·07, this being the highest mortality recorded since 1884. Of the 4,826 deaths, 721 or 15 per cent. were infants and 2,628 or 54 per cent. were children over one and under 12 years of age. Only 7 deaths were recorded in the Arakan division, viz., 2 in Sandoway, and 5 in Akyab. The Pegu division suffered most, its five districts returning 2,875 deaths, of which Tharrawaddy contributed 1,737 or 5·12 per 1,000 of its population. Thongwa in the Irrawaddy division recorded the next highest mortality of 845 or 2·53 per 1,000.

Deaths ascribed to fever rose from 51,752 or 11·46 per 1,000 in 1897 to 53,697 or 11·90, being the highest number yet recorded in the province. By districts the death-rate was highest in Akyab (18·48) and Sandoway (18·33). In seven other districts the provincial rate was exceeded, and in the remainder the rates ranged from 10·93 to 7·29. The town death-rate from fever was 8·23, and the rural rate 12·45, as compared with 7·53 and 12·05 respectively in 1897.

The deaths registered under dysentery and diarrhœa during the year aggregated 8,032, giving a death-rate of 1·78 per 1,000, against 8,793 or 1·95 in 1897. By districts the highest mortality under this head was recorded by Thaton 4·95, followed by Rangoon 4·40, Tavoy 4·36; in the remaining 15 districts the death-rates ranged from 2·66 to 0·42.

Registration of vital statistics is still very backward in Assam. The total number of births registered during the year 1898 was 147,889, giving a ratio of 29·46 per 1,000 of population, as compared with 163,617 or 32·59 in 1897. To some extent the falling off was accounted for by the prevalence of sickness in the previous year. The highest birth-rate was again recorded by Goalpara district, viz., 38·18, followed by Lakhimpur 34·02, Sylhet 30·46, and Darrang 30·09, these being the only four instances in which the provincial rate was exceeded, as the rates of the remaining districts ranged from 28·94 in Sibsagar to 18·66 in Nowgong. **Assam.**

There was a great improvement in the health of the province, and the registered deaths fell from 254,093 in 1897 to 181,527. The death-rate was 36·15 per 1,000 of population, as compared with 50·61 in 1897. In no district were so many deaths registered as in the previous year. In the Surma Valley, comprising the districts of Cachar and Sylhet, the average mortality fell from 54·21 to 37·29, both districts recording an improvement. In the Brahmaputra Valley the average death-rate was 34·92, as compared with 46·97 in the previous year. Of the six districts in this division Nowgong recorded the highest mortality of 47·25 per 1,000, followed by Darrang with 42·25, the ratios of the remaining four districts ranging from 39·03 to 25·93. Taking the province as a whole an excess of deaths over births to the extent of 6·69 per 1,000 was reported.

There was a marked diminution in the mortality from cholera, the number of deaths being 11,149 or 2·22 per 1,000, against 33,240 or 6·62 in 1897. The disease prevailed throughout the year and visited every district. The highest district cholera death-rate was recorded by Kamrup (3·39) in the Brahmaputra Valley, followed by the two Surma Valley districts (Cachar and Sylhet), whose rates were respectively 2·57 and 2·50. The average death-rate from cholera in the towns was 1·87 per 1,000, against 2·23 in the country. Among tea-garden coolies who travelled up the Brahmaputra Valley in steamers there were 26 deaths from cholera, against 371 in 1897 ; and among the coolies at the depots, after landing, there where 58 deaths, against 750.

The mortality from small-pox was a little less than in the previous year, the deaths numbering 5,199 or 1·03 per 1,000, against 5,420 or 1·08. The vast majority of the deaths occurred in the Brahmaputra Valley districts, where there is still a very strong objection to vaccination. Out of 4,768 small-pox deaths in these districts, Nowgong contributed 2,871 or 8·34 per 1,000 of population. The next highest mortality was in Darrang, viz., 688 or 2·24. In no other district did the death-rate from this cause reach 1 per 1,000. Of the total small-pox deaths, 18¼ per cent. occurred among infants, and nearly 51¼ per cent. among children between the ages of 1 and 12 years.

More than a half of the year's mortality was ascribed to fevers, including kala-azar. The number of deaths registered from them was 104,963, representing 20·90 per 1,000 of the population, against 144,307 or 28·74 in 1897. The decrease was chiefly in the Surma Valley, where the mortality sank to nearly one-half what it was in 1897. The highest fever death-rate was again recorded by Nowgong district, viz., 34·54. The provincial fever death-rate was also again exceeded by Goalpara (32·99) and Darrang (28·40). As in previous years, the bulk of the kala-azar deaths occurred in Nowgong district, viz., 10,515 out of the total of 16,472. It is doubtful, it is stated, "whether more than one-quarter or one-third of these deaths were really from that disease, as, especially in the Nowgong district, there is a tendency to call cases of malarial fever which end fatally kala-azar." The Sanitary Comissioner (Colonel Carr-Calthrop) is of opinion that the disease appears to be gradually dying away from the province as a whole.

From dysentery and diarrhœa the deaths were one-third less than in 1897, the number having fallen from 23,136 or 4·61 per 1,000 of population to 16,239 or 3·23. In the Brahmaputra Valley districts the death-rates under this head varied considerably ; thus in Goalpara and Kamrup the rates were 0·38 and 0·95 respectively, while in Sibsagar and Lakhimpur they were 6·90 and 8·54. Colonel Carr-Calthrop knows of no difference in the vital conditions affecting the inhabitants of the upper and lower stretches of the great Assam river which could possibly produce such an extraordinary variation in the death-rate.

The number of births registered in Madras Presidency during the year was 911,747 or 27·4 per 1,000, against 935,845 or 28·7 in 1897. The decrease was attributed partly to the influence of famine in certain areas, and partly to deferred marriages during the past three years. Excluding Madras town, which recorded a birth-rate of 41·6, Chingleput again registered the highest ratio of 35·7, and in five other districts the rate was above 30 per 1,000, while in Malabar and Madura the rates were only 18·6 and 22·7 respectively. Among the 59 municipalities, 12 recorded birth-rates over 40 **Madras.**

per 1,000 ; in 31 towns the rates ranged between 40 and 30 per 1,000, and in 14 others between 30 and 20 per 1,000. The mortality in 1898 was less than that of the previous year by 128,417, the deaths having fallen from 827,525 or 25·4 per 1,000 to 699,108 or 21·0. By districts the highest death-rate (45·2) was recorded in Madras City, and it was nearly 10 per 1,000 higher than that recorded in the previous year. In the other districts the mortality ratios ranged from 30·9 per 1,000 in the Nilgiris to 15·6 in Madura. The average death-rate of the towns was 29·8 per 1,000, and that of rural areas 20·3.

Of the chief diseases, cholera was considerably less fatal than in 1897, the number of deaths having fallen from 143,445 or 4·4 per 1,000 to 65,444 or 2·0. All the districts were affected, but the disease was most severe in Tanjore, Trichinopoly, South Arcot, and Kistna, which recorded cholera death-rates of 6·7, 5·5, 5·2, and 2·9 respectively. "These," the Sanitary Commissioner, Dr. King, states, "are the great irrigation centres of the Presidency, and offer good facilities for the transmission of the cholera microbe from village to village by means of lengthy channels that are liable to contamination, by reason of the insanitary habits of the people." In the remaining districts the rates varied from 2·8 in Nellore to 0·01 in the Nilgiris. The average death-rate in municipal and other towns from the disease was 2·1 per 1,000, against 5·0 in 1897, and that in rural tracts 2·0, against 4·3.

Small-pox deaths were reported from all the districts, and the total in the whole Presidency aggregated 20,490 or 0·6 per 1,000, against 21,678 or 0·7 in 1897. Of the districts, the disease was again very severe in Ganjam, which returned 10,838 deaths ; but this is much lower than the mortality (14,515) in the previous year. In no other district did the death-rate from small-pox reach 1 per 1,000. Of the total small-pox deaths, 3,791, or over 18 per cent., occurred amongst children under 1 year of age, and 9,285, or nearly 45 per cent., among those between 1 and 12 years of age.

From fevers the registered deaths fell from 292,292 or 9 per 1,000 of population in 1897 to 248,638 or 7·5. The decrease was chiefly marked in districts that in 1897 had been affected with famine, and was attributed to better nutrition and better resistance to malaria on the part of the people. On the other hand, the fever death-rate in the Nilgiris rose from 17·0 to 22·1 per 1,000, which was the highest rate recorded by any district, and it was accompanied by a fall in the birth-rate. Five other districts had death-rates of over 10 per 1,000, and eight of over 5 per 1,000. Eight of the 59 municipal towns returned fever death-rates exceeding 10 per 1,000, the highest being 14·8 in Cuddapah and 12·5 in Kurnool.

The number of deaths registered under dysentery and diarrhœa in the Presidency was 29,654 or 0·9 per 1,000, against 38,716 or 1·2 in 1897. The decrease which extended to all the districts but five (Madras, Chingleput, Nellore, Salem, and South Arcot), was attributed to improved dietary of the people following the reduction in the prices of grain. Of the districts, Madras came first with a death-rate from this cause of 7·5, against 4·5 in the previous year, followed by Chingleput with 2·6, and South Canara with 2·0 ; three other districts had rates between 1 and 2 per 1,000. Of the towns, Tuticorin recorded the high death-rate of 9·3 per 1,000, followed by Cochin 7·5, Chingleput 6·8, and Coonoor 6·3.

Plague was imported into the Presidency towards the close of the year, and eleven districts were more or less affected. Precautionary measures were promptly taken, and the spread of the disease was, as a rule, successfully prevented. Up to the end of March 1899 the reported seizures of indigenous plague numbered 2,075, and the deaths 1,681.

mbay. In the Bombay Presidency, including Sind, 582,371 births were registered during the year, giving a birth-rate of 30·94 per 1,000 of population, as compared with 629,693 or 33·46 in 1897. Of the 24 collectorates and districts only four recorded higher rates than in the previous year, the remainder showing a decrease. Bombay City, as usual, recorded the lowest rate, viz., 13·08, which, however, was an improvement on 11·29 in the previous year. The number of births recorded was the lowest for ten years. For the first six months of the year the births registered were very much below the normal, but in July and August there was an improvement, and during the rest of the year the births were considerably in excess of the normal. The decrease is ascribed by the Sanitary Commissioner to the breaking up of family life during the famine, to the reduced stamina of the poorer classes, and to the reduced number of marriages.

In spite of the continued and more extended prevalence of plague the total number of deaths registered in the Presidency fell from 749,916 in 1897 to 548,825, and the rate per 1,000 of population from 39·84 to 29·16, which was made up of district ratios ranging

from 64·03 in Bombay City to 11·04 in Hyderabad. The decrease of 201,091 deaths was spread over all the districts except four. Dharwar district recorded the second highest death-rate (63·81), followed by Belgaum with 41·77. Only three other districts, viz., Broach, Nasik, and Surat, had a death-rate above 30 per 1,000. The high death-rates in Bombay City and Dharwar were due to plague.

The Presidency was remarkably free from cholera during the year, and the deaths fell from 57,109 or 3·03 per 1,000 in 1897 to 4,368 or 0·23. Of these no less than 4,054 occurred in Dharwar district. The five districts of the province of Sind were entirely free from the disease during the year, as were also seven other districts. Of the other affected districts Bombay City came first with 104 deaths, followed by Belgaum 97, Kanara 79, and Kolaba 15. In no other district did the cholera deaths reach double figures. Deaths occurred in every month of the year only in Dharwar and Bombay City, the months of greatest prevalence being June, July, and August. Out of 220 rural circles only 27 were affected by cholera, and 14 out of 56 town circles.

Small-pox deaths fell from 3,835 or 0·20 per 1,000 in 1897 to 1,834 or 0·10. All but three of the districts were affected, but in no case did the death-rate reach 1 per 1,000, the highest rate recorded being 0·42 in Khandesh, the result of 618 deaths. According to age, 27·59 per cent. of the small-pox deaths occurred among infants under one year of age, and 51·69 per cent. among children between the ages of 1 and 10.

The deaths registered in the Bombay Presidency as due to fevers greatly decreased during the year, the number having fallen from 452,596 or 24·05 per 1,000 of population in 1897 to 302,515 or 16·07. These numbers, however, include deaths from plague, from which there were 46,944 in 1897 and 86,191 in 1898. "With the agency at our disposal for the registration of deaths," the Sanitary Commissioner remarks, "and in a country where so many diseases are by the people called fever, it is inevitable that many diseases must be returned under the head of fever which do not rightly belong to this heading. This has always been the case, and although these fever deaths cannot be relied on as being all due to fever, they can, when taken for a number of successive years, give an indication as to the prevalence or otherwise of the common fevers of the country." It is stated, moreover, that the carrying out of plague measures in some of the towns of the Presidency has led to very much more accurate registration in them. The average fever death-rate was exceeded in 9 districts, among the highest being 36·81 in Dharwar, 28·08 in Broach, 27·56 in Bombay City, and 24·52 in Panch Mahals. In only four districts, viz., Belgaum, Dharwar, Broach, and Panch Mahals, was the fever death-rate higher than in the previous year, the increase being due, except in the last named district, to a high mortality from plague.

The number of deaths ascribed to dysentery and diarrhœa also fell from 85,966 or 4·57 per 1,000 of population in 1897 to 56,789 or 3·02, a ratio, however, which is still considerably higher than in any of the ten years preceding 1897—a fact which the Sanitary Commissioner considers due to the after-effects of famine. In nine of the 24 districts the average death-rate under this head was exceeded, the highest being again recorded by Sholapur 6·54, followed by Nasik 6·33, Khandesh 5·90, Satara 5·16, and Belgaum 5·10.

From plague 86,191 deaths were reported during the year, giving a ratio of nearly 4·6 per 1,000 of population, against 49,944 or 2·5 in 1897. The outbreak commenced in September of 1896, at the end of which 2,086 deaths had been reported, being equal to a ratio of 0·12 per 1,000. Up to the end of 1896 ten of the 24 districts had remained free of the disease, but in spite of precautions to check its progress, plague extended to all but two (Kanara and Panch Mahals) of the districts by the close of 1897, though some were but slightly affected. In 1898 all the districts were affected but three in Sind. Of the 86,191 deaths, Bombay City contributed 18,130, an increase of 7,893 on the number reported in 1897, and the death-rate rose from 12·70 to 22·49; but the highest plague death-rate during 1898 was 26·43 in Dharwar, the result of 27,764 deaths. An interesting account of the progress of the plague, and of the measures taken to suppress it, will be found in the Abstract of the Report of the Sanitary Commissioner with the Government of India, at pages 103–118.

Berar.

The total number of births registered in Berar in the course of the year was 89,414 or 31·3 per 1,000 of the population, showing a decrease of 23,950 or 8·4 on the previous year. The decrease was attributed to the effects of the famine which prevailed partly in 1896 and 1897. In all the six districts of the province the birth-rates were lower than in the previous year, and ranged from 33·6 in Akola to 28·4 in Basim.

The deaths fell from 150,222 or 52·6 per 1,000 of population in 1897 to 66,806 or 23·4, a lower rate than had been recorded in any year since the commencement of registration

in 1868, except in 1871 and 1873 when the rates were 17·7 and 22·8. The great decrease in 1898 was attributed to cheapness of the staple food-grain (jowari) of the people, the absence of epidemics, and a reduced temperature, humidity, and rainfall as compared with the previous year. The provincial rate was exceeded in four out of six districts, the exceptions being 20·4 in Wun and 21·0 in Basim; but in no district was the rate half so high as in 1897.

There was not a single death from cholera recorded during the year. This is the more remarkable as in the previous year the disease was epidemic in the province, and the deaths numbered 10,122 or 3·5 per 1,000 of population. Since the introduction of registration in the province only on one previous occasion (1873) were no deaths recorded from cholera.

From small-pox, 592 deaths were registered, as compared with 617 in 1897, the death-rate being the same in both years, viz., 0·2 per 1,000. Nearly 73 per cent. of the deaths (431) were registered in Buldana district, and the fewest number (5) in Akola district. Although the disease was present in several towns, it attained serious proportions only in four in Buldana district. About 45 per cent. of the deaths occurred amongst children under 12 years of age, 91 or 15 per cent. being infants under one year.

Under fevers, a mortality of 32,789 or 11·5 per 1,000 was registered, or about half the number registered in 1897, viz., 65,611 or 23·0. By districts the death-rate from fever varied between 14·8 in Wun and 9·4 in Buldana. Every district showed a reduced rate approaching nearly half the rate of the previous year, and only in two districts (Wun 14·8 and Akola 12·1) was the provincial rate exceeded.

The number of deaths attributed to dysentery and diarrhœa fell from 29,549 or 10·3 per 1,000 in the previous year to 9,942 or 3·5. Ellichpur district, as usual, recorded the highest mortality under this head, viz., 5·9, against 16·4 in the previous year. Akola followed with 4·4, which was also higher than the ratio (13·0) of the preceding year. The other district rates ranged from 3·5 in Basim to 0·9 in Wun. "The comparative lowest dysentery and diarrhœa rate and highest fever rate which the Wun district shows," the Sanitary Commissioner writes, "leads to the supposition that in this district deaths from dysentery are reported and classed as deaths from fevers."

IV.—JAILS.

Sickness and mortality in 1898.

There was a marked improvement in the health of the jail population of India during 1898. The only factors militating against the general health of the jails were the legacy of weakly prisoners convicted in the preceding year, and the overcrowding that took place in a number of the prisons. Not only were the ratios of deaths, admissions into hospital, and daily average number of sick less than in 1897, but they were the lowest in the quinquennium ending with the year under notice. The daily average sick per 1,000 of average strength fell from 39·3 in 1897 to 37·3, the ratio of admissions into hospital from 975 to 917, and the death-rate from 39·64 to 25·34. In every province except the Punjab and Coorg the jail death-rate was lower than in 1897, and in four provinces the rates were lower than in any of the previous five years. In Bengal the rate was the lowest on record, and in Bombay it was the lowest since 1887; while in the Punjab it was the highest since 1893. The Punjab death-rate, however, was not high as jail death-rates go; but the fact that there was a considerable rise is disappointing. There was very little cholera among the prisoners, and in no less than six of the provinces the convicts were entirely free from the disease.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1898, as compared with the previous year :—

Provinces.	1898.			1897.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,037	34	22·5	1,083	36	34·4
North-Western Provinces and Oudh.	921	47	28·7	1,019	50	35·4
Punjab	1,373	37	23·5	1,340	31	16·3
Burma	620	32	20·6	596	29	24·0
Central Provinces	1,134	51	34·6	1,233	65	134·9
Assam	1,185	54	36·6	1,255	51	48·6
Coorg	874	23	92·0	479	11	25·2
Madras	578	27	26·2	672	30	47·4
Bombay	756	27	21·3	807	26	35·2
Berar	581	16	14·9	550	16	34·7
India	917	37	25·3	975	39	39·6

Bengal.

The health statistics of the Bengal jails for 1898 are exceedingly satisfactory, the decline in the death-rate being very marked. The admissions into hospital were in the ratio of 1,037 per 1,000 of average strength, against 1,083 in 1897, the average daily sick-rate was 34 or 2 per 1,000 less, while the death-rate fell from 34·4 to 22·5. These results are mainly attributable to the almost entire absence of cholera, and to the reduced number of admissions from malarial fevers and dysentery and diarrhœa. The year being exceptionally healthy also accounted for the reduced mortality of the jails, but "much credit was also due to medical officers for the care bestowed by them on sick prisoners." Among all classes of prisoners there were 427 deaths, and of these 395 were convicts. Several of the jails were overcrowded during the year. The diseases which contributed chiefly to the convict death-rate (22·9) were dysentery 90 deaths, respiratory diseases 64, pneumonia 69, and malarial fever 43. There were only three deaths from cholera, against 46 in the previous year. Of the convicts who died in jail over 30 per cent. were admitted in good health, about 38 per cent. in indifferent health, and nearly 32 per cent. in bad health. Out of 48 jails the average death-rate among convicts was exceeded in 21, the highest being Barasat 75·0, Purnea 63·6, Chaibassa 55·2, Muzaffarpur 50·3, and in five others the mortality rate was over 40 per 1,000, but several of these have only a small population, and two or three deaths cause a high death-rate. In four jails there were no deaths, and in eight there was only one death in each.

North-Western Provinces and Oudh.

The history of the jails of the North-Western Provinces for 1898 not only shows that there was a considerable reduction in the population as compared with the previous year, but that a great improvement had occurred as regards the sickness and mortality in the jails. This is the more satisfactory considering the large number of weakly prisoners who had been admitted in bad and indifferent health in the previous year. The admissions into hospital fell from 1,019 per 1,000 of average strength in 1897 to 921, the daily average sick-rate from 50 to 47 per 1,000, and the death-rate from 35·4 to 28·7. Of the 56 jails in the province there were no deaths in three, and 36 others recorded death-rates below the provincial jail rate. The highest mortality (81·9) occurred in Mirzapur district jail, the result of 27 deaths, 5 of which were due to dysentery and 8 to pneumonia. Chief among the jails with a low mortality was Bareilly Central Prison, with only 10·6 per 1,000 on an average strength of 2,012 convicts. Not a single case of cholera was reported in any of the jails during the year. Of other diseases, dysentery was accountable for 190 deaths against 307 in 1897. From pneumonia there were 135 deaths against 156 ; other respiratory diseases were also less fatal than in the preceding year. The Inspector General believes that "the prevalence and fatality of pneumonia and other respiratory diseases are to a large extent due to previous epidemics of influenza, as a large proportion of the prisoners who are attacked are severely injured in health, and are particularly liable to suffer from diseases of the respiratory organs. Another important factor in the causation of these diseases is the fact that native prisoners cannot be got to wear their clothing at night. In the coldest nights of winter many of the prisoners remove their blanket coats and cotton clothing, and it is impossible to get the barrack overseers to report prisoners who do so." Of the total 923 deaths 872 were of convicts, their death-rate being 28·8 per 1,000 against 35·2 in the previous year.

Punjab.

The year 1898 was unusually unhealthy in the jails of the Punjab. The admissions to hospital per 1,000 of average strength rose from 1,340 to 1,373, the daily sick-rate from 31 to 37, and the death-rate from 16·3 to 23·5. "Speaking generally," the Inspector General writes, "the increased mortality is ascribable to the serious deterioration of health caused among the prisoners by the prevalence of malarial fevers during the autumn of 1897. It is also possible that the robustness of the prisoners received in 1897 and 1898 had been more or less impaired prior to admission to jail by the scarcity that prevailed in the province during the former year." The provincial death-rate was exceeded in 15 jails, the highest being 60·98 in Kohat, followed by Jhang with 40·59. In four jails there were no deaths. Of the total 294 deaths, all but 18 were of convicts, giving a death-rate of 23·95. One of the most unsatisfactory features of the year was the increase in the number of admissions and deaths from dysentery. Of the total 49 deaths returned under this head 19 or nearly 39 per cent. occurred in the Lahore Central Jail. In combating the disease in this jail "the issue of fresh potatoes and onions in the dietary seemed to exercise an excellent influence." The most fatal disease was pneumonia, the deaths from which (68) increased by 30·77 per cent. There was no case of cholera in any jail. Of the total deaths 37·32 per cent. occurred among convicts who had not been more than six months in jail.

urma.

The Burma jail statistics show that the admissions into hospital and constantly sick during 1897 were higher than in the previous year, the ratios per 1,000 of average strength having risen from 596 and 29 respectively to 620 and 32. The death-rate, however, fell from 24·04 to 20·6. The decrease in mortality was more than accounted for by the decline in cholera deaths from 69 in the previous year to three in 1898. Of the 261 deaths which occurred during the year, 252 were of convicts, the death-rate being 20·39 against 24·11 in 1897. Among the other principal diseases dysentery, malaria, and pneumonia were more prevalent and more fatal, other respiratory diseases and tubercle of the lungs were less prevalent but more fatal, while fewer admissions and fewer deaths were due to diarrhœa. Several of the jails recorded high death-rates, notably Shwebo 75·76, Paungde 73·17, Bhamo 68·97, Rangoon (European) 66·67 Moulmein 50·88, and Kyaukpyu 44·44. Much of the sickness and mortality of the Shwebo jail was attributed to sickly transfers from Katha and Bhamo ; and it is stated that in Bhamo jail most of the victims among the Shans and Kachins were in bad or indifferent health on commitment. Moulmein retains its reputation for unhealthiness. Of the 29 deaths in this jail, 19 were from dysentery. The proposed reduction in the number of prisoners in this jail has, it is stated, been carried into effect.

ntral
ovinces.

The vital statistics of the jails of the Central Provinces for 1898 show a great improvement in the health of the prisoners. The figures, however, are still high comparatively, which is explained by the fact that in the early months of the year new admissions were

still in poor health. The admissions into hospital per 1,000 of average strength fell from 1,233 in 1897 to 1,134, the daily average sick-rate from 65 to 51 per 1,000, and the death-rate from 134·98 to 34·6. Only one (Bhandara) of the 19 jails recorded a higher mortality as compared with the previous year. The average death-rate was made up of jail-rates varying from 94·8 in Bilaspur to 9·3 in Narsinghpur. In four jails there were no deaths. All the jails were free from cholera or any other epidemic, and the admissions to hospital from dysentery and diarrhœa fell to about a third of the number in the previous year, and the deaths to about one-eighth the number. All but 7 of the 175 deaths occurred amongst convicts, the death-rate being 35·18, against 138·3 in 1897. Of the total deaths 70 were of convicts who had not been more than six months in jail.

Assam

Among the prison population of Assam the rate of admissions to hospital fell from 1,255 per 1,000 in 1897 to 1,185 in 1898, the daily sick-rate rose from 51 to 54, and the death-rate fell from 48·7 to 36·6. The improvement in the general health is attributed to the influence of increased diet, to the careful selection of prisoners for extra-mural work, to the use of quinine and iron as a prophylactic during the unhealthy months of the year, and to the unremitting attention on the part of superintendents and their medical subordinates to the treatment and proper dieting of weakly prisoners. In only three of the 23 jails was the average strength above 100, viz., Sylhet, Tezpur, and Gauhati, and these three accounted for 38 out of the total 58 deaths. In most of the other jails the average strength was less than 50. As in the previous year many prisoners were admitted into jail in a moribund condition; of the 18 prisoners who died in Sylhet only 5 were admitted in good health, only 2 out of 13 in Tezpur, and out of seven prisoners who died in Gauhati two were admitted in indifferent health, and the rest in bad health. All but seven of the 58 deaths occurred amongst convicts, being in the ratio of 35·43 per 1,000 against 48·14 in 1897. Only two cases of cholera occurred during the year, one at Tezpur, which terminated fatally, and one at Tura; in the previous year there were 11 deaths from cholera. From dysentery and diarrhœa there were 21 deaths, and from malarial fevers 13.

Madras.

In the jails of Madras Presidency the general health of the prisoners during 1898 was particularly favourable. The hospital admission rate fell from 672 per 1,000 of average strength in 1897 to 578, the daily sick-rate from 30 to 27 per 1,000, and the death-rate from 47·45 to 26·2. Cholera was practically absent, only nine deaths having been recorded from the disease as compared with 236 in 1897; there was also a considerable reduction in the number of cases of dysentery, but the rate of mortality (6·04) remained about the same. Pneumonia, on the other hand, was much more frequent and fatal, as were also other respiratory diseases. The highest death-rate was that of Rajahmandry, viz., 193·14, against 123·08 in the previous year. The general health of the convicts at Rajahmandry was very bad, and the mortality under all the chief headings was excessive. Excluding Rajahmandry jail, the provincial death-rate would have been only 18·59 per 1,000. Of the 97 deaths which occurred in this prison, 71 occurred among convicts who had been less than six months in jail. An enquiry was held into the prevalent sickness and mortality of the jail, when it was found that the ailment was beri-beri, "a dangerous endemic infective dropsy." Special sanitary measures were recommended and have recently been adopted, and it is satisfactory to learn that the health conditions have since improved very materially. In none of the other jails with a strength of over 200, except Vizagapatam and Trichinopoly, with death-rates of 49·26 and 31·16 respectively, did the mortality reach the Presidency rate; while in six jails there were no deaths. Of the total 287 deaths convicts contributed 257, representing a ratio of 28·09 per 1,000 of average strength, as compared with 50·49 in 1897.

Bombay.

Although nearly all the jails in the Bombay Presidency were overcrowded during 1898, there was a marked improvement in health of the prisoners as compared with the previous year. The rate of admissions to hospitals per 1,000 of average strength fell from 807 to 756, the daily sick-rate (27) was 1 per 1,000 more, while the death-rate declined from 35·28 to 21·3 per 1,000. Five jails recorded a higher mortality than in 1897, but in no case was there any marked increase; while in several the figures showed a great improvement over those for 1897. Six out of the 17 jails recorded death-rates above the average, viz., Sind Gang 64·4, Shikarpur jail 58·8, Common Prison 52·9, House of Correction 44·5, Dharwar 30·8, and Thana jail 26·7. All but 23 of the total 216 deaths (including 10 in the lock-ups) occurred among the convicts, their death-rate being 22·5 against 37·8 in 1897. The chief causes of mortality were dysentery and diarrhœa 28 deaths, respiratory diseases 49, including 41 from pneumonia, fevers 19, and tubercle of the lungs, &c., 15. In

spite of the prevalence of plague in the Presidency only 37 cases occurred among the prisoners, of which 20 proved fatal. Not a single case of cholera was recorded in any of the prisons. In the previous year there were 41 cholera deaths, of which Thana jail contributed 37, being more than a third of its total mortality of 118·9 per 1,000, as compared with 26·7 in the year under notice. Pneumonia, as usual, was very prevalent in the Sind jails, 109 cases, out of a total of 155, having occurred in them, and 27 of the 41 deaths. The Sind Gang and Shikarpur jails were the chief sufferers, with 13 deaths in each.

The health of the jail population of Berar in 1898 was on the whole satisfactory ; there was slightly more sickness, but the mortality was considerably less. The rate of admissions into hospital per 1,000 of average strength rose from 550 to 581, the daily sick-rate remained the same (16), while the death-rate fell from 34·7 to 14·9. There was no outbreak of epidemic disease in any of the jails, and little cholera. There were only 24 deaths against 66 in 1897. Nineteen of the 24 deaths occurred in the larger jails at Akola and Amraoti, nine in the former and 10 in the latter ; but the highest death-rate was recorded by Basim, 30·6, the result of three deaths ; Ellichpur followed with a rate of 19·5, the result of only one death. All but two of the 24 deaths occurred amongst convicts, their death-rate being 15·28 per 1,000, as compared with 33·12 in 1897.

V.—VACCINATION.

General results.

During 1898-99 there were 6,860,915 persons successfully vaccinated in the several provinces of India, being a decrease of 283,559 on the number of the previous year. To some extent the decrease in vaccination work was due to the withdrawal of some of the officers of the provincial Vaccination Departments for duty in connection with plague prevention. According to age, over $2\frac{3}{4}$ millions (2,841,126) of the total were children under one year of age, and over 3 millions (3,002,771) were children between the ages of one and six years. The proportion of population protected against small-pox by the year's operations ranged from 53·03 in Burma to 26·66 in Madras. In the vaccination of infants the best results were, as usual, obtained in Berar, the Punjab, and Bombay, where 60·31, 59·97, and 49·91 per cent. respectively of the children born during the year (estimated at 40 per 1,000 of population) were protected against small-pox. In the Central Provinces the percentage was 44·61, and in the remainder it ranged from 37·71 in Burma and 33·80 in the North-Western Provinces and Oudh to 7·38 in Coorg.

Statement showing the total number of persons successfully vaccinated during the year 1898–99 :—

Province.	Population among whom Vaccination was carried on (Census of 1891).	Number of Persons successfully vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Children born during the Year (calculated at 40 per 1,000 of Population) successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	71,092,411	2,085,904	28·05	502,300	1,359,636	17·66
North-Western Provinces and Oudh.	47,146,033	1,269,493	26·92	637,472	483,106	33·80
Punjab	20,553,982	727,826	35·41	493,085	122,066	59·97
Burma	8,146,855	443,195	53·03	122,895	212,384	37·71
Central Provinces	12,900,386	421,654	31·70	230,220	103,390	44·61
Assam	5,634,258	242,229	40·58	50,389	125,645	22·36
Madras Presidency	35,651,577	960,562	26·66	282,969	462,640	19·84
Bombay Presidency	22,612,220	604,679	26·67	451,398	114,673	49·91
Berar	2,897,040	100,275	34·61	69,887	17,132	60·31
Coorg	173,055	5,098	27·92	511	2,099	7·38
TOTAL	226,807,817	6,860,915	30·24	2,841,126	3,002,771	31·31

Bengal.

The total number of vaccinations performed in Bengal during 1898–99 was 2,147,452 of which 2,085,904 were successful, against corresponding figures in 1897–98 of 2,319,536 and 2,244,716. This shows a decrease of 172,084 vaccinations in 1898–99, which Dr. Dyson states "is due chiefly to the plague inoculation scare, and to the introduction of the six-puncture system of vaccination. The extra two points of vaccination were looked upon by the ignorant masses of the people as in some way connected with plague inoculation, and this retarded the progress of vaccination and accounts for the smaller number of operations performed during the past year." Although there was a decrease in the number of vaccinations for the year as compared with 1897, there was an increase of 155,053 in the triennial average, which shows that progress is being made. The primary operations numbered 2,087,285, of which 97·99 per cent. were successful. According to age, 502,300 of the successful primary vaccinations were of children under one year of age, and 1,359,636 were between one and six years. For the whole province the successful vaccinations were in the proportion of 28·05 per 1,000 of the population. Estimating the births during the year at 40 per 1,000, the percentage of infants successfully vaccinated was 17·66, which is far below that attained in other provinces except Coorg.

Three methods of vaccination are practised in the province—(1) with lymph taken direct from the calf; (2) with calf lymph prepared with lanoline; (3) with human lymph taken by arm to arm transfer. Compared with the previous year's figures there was an increase of 31,082 in the number of primary operations performed direct from the calf. As regards the attitude of the people towards vaccination, Dr. Dyson reports that there

is still much opposition to it in many districts, particularly in Puri and in some of the Behar districts, where "the people are generally averse to vaccination, and look upon inoculation with favour." Another hindrance, he says, is the difficulty experienced by licensed vaccinators in some places in realizing their fees.

North-Western Provinces and Oudh.

The steady progress in vaccination which had characterized the North-Western Provinces in previous years was arrested in 1897–98. This was due chiefly to the low birth-rate of the year. There were besides other special difficulties: many of the children in the famine-affected districts were in too reduced a condition to undergo the operation, and the time of the officers of the Vaccination Department was much occupied with plague duties. The results of 1898–99 were more satisfactory. The total number of persons vaccinated rose from 1,385,005 in 1897–98 to 1,398,684 in 1898–99, and the successfully vaccinated from 1,224,603 to 1,269,493. The proportion of persons protected by vaccination is still very small, the ratio for the year being only 26·92 per 1,000. Primary vaccinations numbered 1,340,036, of which 94·96 per cent. were successful. Of the 1,269,493 successful primary cases, 637,472 were infants and 483,106 were children over one and under six years of age. Estimating the births at 40 per 1,000 of the population, 33·80 per cent. were successfully vaccinated during the year.

Since the 1st February 1896 the areas of operation have been rearranged in two circles for the purposes of control, each being in charge of a Commissioned Medical Officer, acting as Superintendent of Vaccination and Deputy Sanitary Commissioner. In the first circle, the average ratio of success of its 27 districts equalled 27·60 per 1,000 of the population. In the second circle, the average ratio of its 22 districts was 26·33. The Vaccination Act is in force in all the municipalities, but the thoroughness of enforcement is said to vary considerably. In the municipalities there was an increase of 2,672 in successful primary vaccinations, and the proportion of persons successfully vaccinated per 1,000 of population rose from 32·51 per 1,000 in 1897 to 33·11 in 1898.

Punjab.

There was a further falling of in the number of vaccinations in the Punjab, as compared with the preceding year. Altogether 840,868 operations were performed in 1898–99, showing a decrease of 4,623 on the figures of 1897–98. Various reasons were assigned for the decline in the work; but these not being considered satisfactory, the Local Government asked for further explanation. The decrease, however, was entirely under secondary operations, as the primary vaccinations rose from 631,774 in the previous year to 661,937, of which 94·84 per cent. were successful. The Sanitary Commissioner hoped that there would be a greater increase in 1899, and that there would be an improvement in re-vaccinations. "The importance of re-vaccination," he writes, "is often forgotten. Primary vaccination protects infants and young children, but leaves the older generation unprotected or only partially protected." The number of successful cases among children under one year of age rose from 476,723 or 57·5 per cent. of the births, calculated at 40 per 1,000 of population, to 493,085 or 59·9 per cent. The provincial ratio of persons successfully vaccinated per 1,000 of the total population was 35·41, against 35·04 in the previous year. During the year the Vaccination Act was extended to the municipal town of Gujranwala, and at the end of the year it was in force in 19 towns.

Burma.

Satisfactory progress was made in vaccination work in the province of Burma during 1898-99. The total number of persons vaccinated was 480,657, as compared with 431,550 in the previous year. Out of 447,858 primary cases, 94·77 per cent. were successful, a ratio identically the same as in the previous year. The number of infants protected was 122,895, equal to about 38 per cent. of the births, estimated at 40 per 1,000 of the population. The returns for the Rangoon municipality were still far from satisfactory. There was again a decrease in the number of primary vaccinations, but a large increase in the number of re-vaccinations. The Vaccination Act is now in force in all the municipalities of the province. The attitude of the people towards vaccination is, the Superintendent General says, not by any means conciliatory, especially in rural areas, and much remains to be done before they get over their prejudices and take kindly to the operation.

Central Provinces.

Vaccination work in the Central Provinces was considerably hampered during 1897–98 by the famine. A return to more prosperous times, a higher birth-rate, and lower infantile mortality, was followed by satisfactory improvement in the work of the department. There were 449,250 persons vaccinated during 1898–99, showing an increase of 50,551 on the number of the previous year. Primary vaccinations rose from 347,210 to 383,633. The percentage of success in primary cases was 96·82, against 96·67, and the proportion of the total population protected by vaccination was 31·70 per 1,000, as compared

with 28·39 in 1897–98. Of the 18 districts in the province, only four showed a decrease in primary operations, against 12 in the previous year. In the protection of infants there was an increase of 42,783, the number vaccinated under one year of age during the year having risen from 187,437 to 230,220. Animal lymph supplied the bulk of the vaccination, and worked very successfully, and there is now very little prejudice against its use in the province. Arm-to-arm vaccination is now practised in very few places. With the lymph obtained from calves, 270,737 children were vaccinated during the year, and of these 254,561 were successful.

Assam.

There was a considerable falling off in vaccination work in Assam during 1898–99, particularly in the districts of Sibsagar and Nowgong. There were 258,905 operations performed by all agencies in the province ; which is a decrease of 25,009 on the figures of 1897–98. There was, however, an improvement in several of the districts, especially in Kamrup and the Garo Hills, where the operations were greater by 7,909 and 7,068 respectively. The largest decrease occurred in Sibsagar district (12,644), followed by Nowgong (10,312). Of the total operations 237,008 were primary cases, and of these 98·35 per cent. were reported as successful. The Compulsory Vaccination Act was in force during the year in the same 11 towns as in the previous year, their population being 71,128. The number of infants successfully vaccinated was 50,389, representing only 22·36 per cent. of the births, estimated at 40 per 1,000 of the population, and the proportion of the population successfully vaccinated was 40·58 per 1,000. Arm-to-arm vaccination has now been practically abandoned throughout the province, and no operations of this class were reported during the year.

Madras.

The total number of vaccinations performed in the Madras Presidency during 1898–99 was 1,117,993, being a decrease of 153,736 on the operations of the previous year, the falling off being mainly attributable to a confusion by the people of vaccination with plague inoculation. Of the total, 1,039,713 were primary cases, of which 89·5 per cent. were successful, against 92·0 per cent. in 1897–98. The number of children under one year of age successfully vaccinated fell from 331,297 to 282,969, which represented only 19·84 per cent. of the estimated births, being 3·4 below the percentage of the previous year. Vaccination is compulsory in all municipalities, and the number of operations performed by municipal vaccinators rose from 118,655 to 127,724. In the town of Madras the number of operations performed was 28,186, a decrease of 4,896 on the previous year, which was chiefly due to a diminution in the number of unprotected children in consequence of a decrease in the number of births. Of the 21 districts, all but three (Ganjam, Vizagapatam, and Godavari) recorded a decrease of work, the most marked cases being those of Salem (28,501), South Arcot (23,993), and North Arcot (23,844). The increase in Vizagapatam was satisfactory, as the heaviest fall occurred in this district in the previous year. The operations were performed solely with animal lymph, and the best results were obtained, as usual, from calf-to-arm vaccination, with a percentage of success of 97·2 against 97·5 in the previous year.

Bombay.

The plague epidemic again seriously interfered with vaccination work in Bombay Presidency. The work was also affected by the absence of inspectors and vaccinators on plague duty, by the very low birth-rate of the two previous years, and high death-rate of 1897, and by the movements of the people in parts on account of scarcity and plague. Omitting the statistics of five Native States which are not under the supervision of the Vaccination Department, the out-turn of vaccination work in the Presidency fell from 744,650 operations in 1897–98 to 674,950. The total primary cases fell from 681,289 to 623,796 ; the percentages of success being respectively 91·84 and 92·84. The substitution of animal for human lymph continued to increase in the Presidency. In the City of Bombay vaccination with animal lymph has been in use for many years past. Of the 579,144 primary successful cases, nearly 78 per cent. were infants under one year of age. Reckoning the births at 40 per 1,000 of population, about 50 per cent. were protected from small-pox. Inoculation was not practised anywhere in the Presidency during the year, and no instances were reported of any disease having been communicated through vaccination.

Berar.

Vaccination work continues to make satisfactory progress in Berar. During 1898–99, 132,903 operations were performed, against 125,289 in 1897–98. The increase, however, was again entirely under revaccinations, as the primary vaccinations fell from 95,048 to 94,032 ; while the percentage of success rose from 96·4 to 97·1. Of the total number of successful primary operations, 69,887 were performed on infants under one year of age ; estimating the births at 40 per 1,000 of population, 60·3 per cent. were protected from small-pox. The decrease in primary vaccinations was confined to the three districts of

Amraoti, Ellichpur, and Wun, but in the remaining three districts the increase was not very great. In revaccinations there was an increase of 8,630, which was spread over all the districts except Buldana. The Sanitary Commissioner continues his statement showing the efficacy of vaccination in checking small-pox mortality in Berar ; the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of five years 1868–69 to 1872–73, to 33·6, the mean of five years ending 1897–98 ; the mortality from small-pox for the same periods has declined from 2·02 to 0·19 per 1,000. In 1898–99 the ratio of successful vaccinations per 1,000 of population was 34·6, and the death-rate from small-pox 0·2 per 1,000. The Vaccination Act is now in force in all the municipal towns.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1898 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1898	487	42,086	2,837,759	2,879,845
	1897	477	55,644	2,778,468	2,834,112
Calcutta and Howrah	1898	15	23,732	187,518	211,250
	1897	16	28,955	260,806	289,761
North-Western Provinces and Oudh	1898	369	55,589	3,801,255	3,856,844
	1897	355	56,936	3,635,480	3,692,416
Punjab	1898	267	49,068	2,976,321	3,025,389
	1897	265	52,381	3,241,543	3,293,924
Burma	1898	105	34,091	765,430	799,521
	1897	99	34,102	754,458	788,560
Central Provinces	1898	125	11,179	1,536,739	1,547,918
	1897	121	14,170	1,512,489	1,526,659
Assam	1898	108	6,977	603,290	610,267
	1897	101	7,222	602,268	609,490
Coorg	1898	7	1,381	40,015	41,396
	1897	7	1,832	49,970	51,802
Madras	1898	486	60,244	4,209,331	4,269,575
	1897	480	63,130	4,247,138	4,310,268
Bombay	1898	325	46,468	1,787,787	1,834,255
	1897	323	47,763	1,766,783	1,814,546
Berar	1898	47	3,460	301,527	304,987
	1897	47	6,789	318,977	325,766
TOTAL	1898	2,341	334,275	19,046,972	19,381,247
	1897	2,291	368,924	19,168,380	19,537,304

Bengal. There was a further increase in the number of charitable dispensaries in Bengal in 1898, and in the patients under treatment in them, as compared with the figures of the previous year. The total number of dispensaries at work during 1898 in Bengal, exclusive of the medical institutions at Calcutta, was 487, an increase of 10 on the number of the preceding year. At these there were 2,879,845 patients under treatment, 42,086 being in-door and 2,837,759 out-door patients, against 55,644 and 2,778,468 respectively in the previous year. This shows a total increase of 45,733, which was entirely in out-door patients, as the in-door patients decreased by 13,558. The increase in the number of out-door patients is considered particularly satisfactory, "inasmuch as it occurred in an exceptionally healthy year, and one in which the fear of plague measures might have been expected to deter the people from having recourse to Government dispensaries."

There was again a satisfactory increase in the number both of women and children patients. The increase among women amounted to 3,742, the number having risen from 458,670 to 462,412. The proportion of women was, however, slightly lower than in the previous year, "owing to the credence given to rumours that Government plague measures in some way affected the honour and safety of women." Of the diseases

under treatment at the dispensaries, malarial fevers, skin diseases, and dysentery and diarrhœa were responsible, as usual, for the largest number of cases. From malarial fever there were 527,695 cases, equal to nearly 18½ per cent. of the total number of patients, against 536,428 in 1897; from skin diseases the number of cases rose from 379,437 to 402,890; from dysentery and diarrhœa there were 154,117 cases, against 166,516 in 1896; and from cholera the number of patients fell from 16,845 to 6,425. Cases of venereal diseases rose from 72,507 to 77,603. The number of deaths among in-door patients fell from 8,172 or 146·8 per 1,000 of total treated in 1897 to 4,718 or 112·0 in 1898. Great attention is paid in these institutions to surgery, and during the year 137,123 operations were performed, against 135,507 in 1897, and of these 180 terminated fatally. Among the more important operations there were 2,259 cases of extraction of the lens.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1898 and the previous year :—

Name of Institution.	1898.				1897.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	4,667	28,386	33,053	109·2	4,672	36,424	41,096	121·5
Eden Hospital	1,413	3,423	14,836	77·1	1,595	3,811	5,406	78·3
Ezra Hospital..	244	—	244	24·5	178	1,063	1,241	22·4
Shama Churn Law Eye Hospital	505	11,058	11,563	—	554	15,941	16,495	1·8
Presidency General Hospital	2,468	717	3,185	44·9	2,391	525	2,916	40·5
Campbell Hospital	7,524	17,826	25,350	229·7	12,041	21,308	33,349	242·3
Police Hospital	3,011	—	3,011	8·6	2,577	—	2,577	12·0
Mayo Native Hospital	1,437	19,673	21,110	96·7	1,978	32,486	34,464	123·8
Chandney Hospital	246	33,050	33,296	81·3	243	44,941	45,184	94·6
Park Street Dispensary	—	21,808	21,806	—	—	29,046	29,046	—
Chitpore Dispensary	—	13,826	13,826	—	—	22,484	22,484	—
Sukea's Street Dispensary	—	11,363	11,363	—	—	16,750	16,750	—
Dufferin Victoria Hospital	149	4,562	4,711	6·7	185	5,305	5,490	5·4
Sambu Nath Pandit Hospital	606	11,186	11,792	176·5	766	18,888	19,654	201·0
Total Calcutta Hospitals and Dispensaries	22,270	176,878	199,148	123·8	27,180	248,972	276,152	153·3
Howrah General Hospital	1,462	10,640	12,102	207·9	1,775	11,834	13,609	277·1
Grand Total	23,732	187,518	211,250	129·0	28,955	260,806	289,761	160·9

The figures for 1897 show a decrease of 73,288 in out-door patients, and of 5,223 in in-door patients. The death-rate for all the hospitals was 129·0 per 1,000 of the total in-patients, against 160·9 in the previous year. Cholera patients fell from 1,200 to 227, and the fatal cases from 664 to 122. The decrease was most marked in the Campbell Hospital, where only 89 cases were treated against 535 in the previous year. Small-pox was less prevalent in Calcutta than in the previous year, and the cases admitted to hospital declined from 218 to 37. Dysentery was less prevalent, and the number of patients fell from 8,415 to 5,571. The number of patients treated for diarrhœa was also less, viz., 6,244 against 9,836; malarial fever was responsible for 37,276 patients against 46,025. Venereal diseases show a decrease of 3,592 patients, the number treated having fallen from 14,523 in the previous year to 10,931. Surgical operations decreased from 25,745 to 21,610, and death ensued in 154 cases, against 178 in 1897.

North-Western Provinces and Oudh.

During 1898 there were 369 hospitals and dispensaries at work in the North-Western Provinces and Oudh, or 14 more than in the previous year. The number of patients who received medical aid was 3,856,844, against 3,692,416 in 1897. There was thus an increase in 1898 of 164,428, which was entirely among out-patients, as the in-patients declined from 56,936 to 55,589. The figures, however, indicate a return to normal conditions, as there had been a falling off in 1897, "owing to the fears excited by plague preventive measures, and to the fact that many people who might otherwise have come to dispensaries flocked to famine poor-houses and relief works." Of the total number, 52·5 per

cent. were men, 22·6 per cent. were women, and 24·8 per cent. were children, the two latter showing a small increase on the figures of the previous year, which were 22·4 and 24·2 respectively. Among the in-door patients there were 2,801 deaths, giving a death-rate of 50·3 per 1,000, against 4,514 or 79·2 in the previous year. Of the diseases for which the patients were treated 692,233 were suffering from malarial fevers, a decrease of 20,789 on the number of 1897 ; cases of cholera fell from 3,585 to 368, and cases of diseases of the eye rose from 302,319 to 318,522. From venereal diseases there were 95,165 patients, against 89,012 in the previous year. The number of surgical cases rose from 168,538 to 175,708, of which 142,629 resulted in cure and 366 were fatal. Of the total operations 5,648 were for cataract, of which nearly 83 per cent. were successful, as compared with 6,566 operations and a percentage of success of 81 in 1897.

Punjab.

The number of dispensaries at work in the Punjab during 1898 was 267 or two more than in the previous year. At these, 3,025,389 patients were under treatment, being a decrease of 268,535 on the number of 1897. The attendance of in-door patients was less than in the previous year by 3,313, the number having fallen from 52,381 to 49,068. The decrease was attributed partly to greater care being taken about the class of patients admitted so as not to convert the hospital into a poor-house, and partly to several dispensaries having to be closed on account of the staff and many civil surgeons being taken away for plague duty ; the latter cause, and a more healthy year, contributed greatly to the decrease in out-patients. Of the diseases for which patients sought relief there were only three cases of cholera, being a decrease of 95 on 1897. Cases of malarial fever fell from 646,471 to 463,223. Diseases of the eye showed a decrease of 633 cases, the number treated in 1898 being 381,408, against 382,041. From venereal diseases there were 28,659 cases under treatment, a decrease of 2,260 on the previous year's figures. Among the in-patients there were 2,061 deaths during the year, being in the ratio of 42·0 per 1,000 of the number treated, against a death-rate of 47·5 in 1897. In surgical work the operations decreased from 173,808 in 1897 to 170,809. Of these, 164,164 were cured and 278 died. There were 4,534 cataract operations, and of these 87·5 per cent. resulted in cure.

Burma

The number of dispensaries existing in Burma at the end of 1898 was 105, or six more than in the previous year. At these, 799,521 patients attended, as compared with 788,560 in 1897. In-door patients were slightly fewer, the number having declined from 34,102 to 34,091, of whom 24,860 were cured, and 2,487 or 73 per 1,000 died, against 2,613 deaths or 80 per 1,000 in the previous year. Nearly three-fifths of the patients treated were Burmese. Malarial fevers, as usual, headed the list of maladies under treatment, the number of cases being 127,177, against 130,180 in the previous year. Cholera was less prevalent than in 1897, and the number of cases fell from 914 to 342, of which the majority were in the lower part of the province. Cases of venereal disease rose from 27,164 in 1897 to 28,966. Surgical work showed a decrease of 1,224 operations, the number performed during the year having fallen from 17,714 to 16,490 ; the falling off was due to the smaller number of abscesses being opened, and to the comparative healthiness of the year. The number of patients cured, after being subject to operation, was 15,684, and 85 died.

Central Provinces.

The number of hospitals and dispensaries at work in the Central Provinces during 1898 was 125, or 4 more than in the previous year. The total number of patients rose from 1,526,659 to 1,547,918. The increase, however, extended only to out-door patients, the in-door patients having fallen from 14,170 to 11,179. Among the in-patients there were 1,042 deaths or 93·2 per 1,000 of total treated, against 1,905 or 134·4 in 1897. As regards the different kinds of diseases, the most remarkable features were the large decrease of cases of malarial fevers by 17,533, against an increase of 47,713 in the previous year, a fact which points to the healthy character of the year, and of 32,063 cases of dysentery and diarrhœa. From venereal diseases there was an increase of 2,596 cases. There were 39,552 surgical operations performed, against 35,102 in 1897. Of these, 37,176 resulted in cure and 65 in death. In the four years ending 1896 there had been a considerable increase in operations for cataract, viz., from 479 in 1893 to 1,508 in 1896 ; in 1897 they fell to 964, but rose again in 1898 to 1,026.

Assam.

In the province of Assam there were 108 dispensaries at work during the year, or seven more than in the previous year. Notwithstanding the healthiness of the year the number of patients was greater than in 1897, "a gratifying sign that the advantages offered by dispensaries are becoming more appreciated." The total number of patients treated was 610,267, against 609,490 in 1897. The in-patients declined from 7,222 to 6,977, and of these 3,955 were discharged cured, 512 relieved,

1,111 discharged otherwise, and 1,121 died, the latter representing 160·7 per 1,000 of the total in-patients, against a ratio of 209·4 in 1897. The number of natives of the country treated as in-patients rose from 1,772 in 1897 to 1,844, but the number of foreigners fell from 5,450 to 5,133, mostly *ex*-tea-garden and *ex*-railway coolies, many of them being admitted in a moribund condition, which partly accounts for the high mortality in the dispensaries during the year. Of the total number of persons who received medical aid, malarial fever accounted for 177,470 cases, including 5,572 suffering from kala-azar; skin diseases other than ulcers 104,598, worms 81,756, dysentery and diarrhœa 32,874, and diseases of the digestive system 28,776. Cholera patients numbered 2,972, against 3,026 in 1897. More than half (1,621) were under treatment in the Manipur dispensary, an unprecedented epidemic of cholera having occurred in Manipur during the year. Of surgical cases there were 14,701, of which 14,004 were cured and 32 were fatal.

Madras. Exclusive of the hospitals in the Presidency town there were 472 civil hospitals and dispensaries working in Madras at the close of 1898, or six more than in 1897. There were 4,067,111 patients under treatment, as compared with 4,092,551 in 1897. There was thus a decrease of 25,440. Of the 41,660 in-door patients, 25,298 were returned as having recovered fully under treatment, 8,824 as relieved, and 3,023 as otherwise discharged. The deaths numbered 2,963, representing a ratio of 71·1 per 1,000 of the total in-patients, against 80·4 in the previous year. Ulcers and diseases of the skin, diseases of the eye, diseases of the digestive system, malarial fevers, rheumatic affections, dysentery, and worms were the most common diseases under treatment during the year. Cholera was much less prevalent in the Presidency than in the previous year, and the cases under treatment in the various hospitals and dispensaries fell from 23,500 to 9,783. From venereal diseases there were 83,328 cases, against 79,570 in 1897. The surgical operations fell from 150,766 in 1897 to 147,001. Of these, 136,295 were cured and 216 terminated fatally.

The number of medical institutions in Madras town remained the same as in 1897, but the number of sick treated declined from 217,717 to 202,464. The in-patients fell from 18,908 to 18,584, and amongst them 9,142 cases were recorded to have been cured or perfectly recovered, 4,040 were relieved, 3,041 discharged otherwise, and 1,494 or 80·2 per 1,000 died, against a rate of mortality in 1897 of 60·5. The high mortality was due to the general unhealthiness of the year, and to the aggravated forms of disease treated. Of the several diseases for which the patients were treated, malarial fever, diseases of the digestive system, skin, and respiratory system were, as usual, the most common. From cholera there were 505 cases, from dysentery and diarrhœa 7,344, and from venereal diseases 4,523. The surgical operations performed in 1898 decreased from 31,794 to 28,725. The results showed that 13,739 cases were cured, 3,791 relieved, and 137 were fatal.

At the Madras Voluntary Venereal Hospital, which is included in the above hospitals in the city, there were 638 female patients treated during 1898, an increase of 80 on the number of the previous year.

Bombay. Excluding the 11 medical institutions in the City of Bombay, there were 314 hospitals and dispensaries working in the Presidency at the end of 1898. At these, 1,751,236 patients were under treatment, of whom 29,904 were in-door and 1,721,332 out-door patients, against 32,585 and 1,710,219 respectively in 1897. There was thus an increase of 8,432, all being out-patients. As in the previous year, the prevalence of plague had an important indirect effect on the mofussil hospitals and dispensaries in diminishing the attendance of patients, certain institutions having to be temporarily closed owing to the withdrawal of their hospital assistants for plague duty. Malarial fevers, as usual, constituted by far the largest number of cases (302,105), an increase of 20,464 on the figures of the previous year. Next to fever, eye and skin diseases and worms were the most common ailments. Small-pox cases were slightly less numerous, the number having fallen from 495 in 1897 to 438; cholera cases fell from 5,741 to 606; dysentery cases were also less numerous; while patients suffering from venereal affections rose from 24,580 in 1897 to 27,217 in 1898. Of the in-door patients 21,834 were cured, 1,917 relieved, 1,891 discharged otherwise, and 3,071 died, the ratio of deaths to total treated being 103 per 1,000, against 146 in the preceding year. The total number of patients operated on was 83,255, as compared with 82,564 in 1897, and of these 68,915 were cured and 190 died.

The total number of patients treated at the 11 civil medical institutions working in the town of Bombay during 1898 showed an increase of 11,277, the figures being 83,019, against 71,742 in the previous year. The in-patients increased in number from 15,178

to 16,564, and of these 10,144 were cured, 2,518 relieved, 883 otherwise discharged, and 2,063 died, the deaths being in the ratio of 125 per 1,000 of the in-patients, against 136 per 1,000 in 1897. As usual, local injuries, malarial fevers, eye diseases, and skin diseases were responsible for the majority of the cases. Venereal diseases contributed 3,771 cases, against 4,445. There were no cases of cholera under treatment; those of dysentery fell from 1,384 to 1,040; while diarrhœa cases rose from 2,795 to 2,830. The total number of patients operated on was 18,399, and of these 12,368 were cured, 243 relieved, 54 discharged otherwise, and 163 died.

Berar.

There were 47 medical institutions at work in Berar during 1898, the same as in the previous year. Of these, eight are hospitals wholly maintained by the State. The total number of patients under treatment was 304,987, against 325,766 in 1897. In in-patients there was a decrease of 3,329, and in out-door patients of 17,450. The Inspector General says: "There was no famine in the year under report to fill our charities with in-"patients as in the previous year, and the year itself was comparatively a healthier one "as gauged by the death-rate per mille of the population of the province for the two "years 1897 and 1898, which was 52·6 and 23·4 respectively. These two favourable "features would account for the general fall in attendance during the year." Of the in-patients, 2,894 were cured and 193 died, which gives a death-rate of 56 per 1,000, as compared with a mortality of 923 or 136 per 1,000 in 1897. Malarial fevers continued to head the list of diseases from which relief was sought, but the cases again fell from 66,566 in 1897 to 66,288; nearly a fifth of the total patients were treated under this head; diseases of the eye and diseases of the digestive system came next in order. The number of surgical operations was 10,606, against 9,944 in 1897. Of these, 10,368 were cured and 22 died.

Attendance at the Secunderabad Civil Hospital, not included in the above total, showed an improvement, the number of in-patients having risen from 603 in 1897 to 608, and out-door patients from 19,024 to 19,784. The surgical operations rose from 618 to 898.

The Dufferin Hospital for women and children at Amraoti, which was opened on the 15th February 1895, showed a decline in work as compared with that of the previous year. The in-door patients during 1898 numbered only 143, against 257 in the previous year, and the number of out-door patients (5,913) remained the same.

Lunatic Asylums.

Bengal.

At the five asylums in Bengal (viz., Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,083 lunatics, including 159 fresh admissions and re-admissions, were under treatment in 1898, being a decrease of 36 on the number of the previous year. In the course of the year under notice 71 patients were discharged as cured, and 28 as improved or otherwise, and 73 died. Compared with the figures of 1897, the number discharged was less by 14, and the mortality by 17. At the end of the year there were 911 persons still under detention, or 12 less than at the close of 1897. There was a marked improvement in the health of the inmates of the asylum, the average daily number of sick being 105, against 129, and the death-rate (79·1 per 1,000 of average strength) was the lowest on record during the last 13 years, except 1890, and nearly 20 per 1,000 below 1897. The cause of insanity was traceable only in 61 of the 159 fresh admissions, 21 of these being ascribed to ganja. The results of the working of dairy farms at the asylums were satisfactory. At Dullunda there was a profit of Rs. 641 as compared with a loss of Rs. 1,134 in the previous year, when "a number of dry cows had to be fed until they "were disposed of, and in a year of scarcity the cost of up-keep of such cows was very "high." At Dacca the dairy showed a small profit of Rs. 37. The dairy farm at Berhampore, which was opened in the latter part of 1896, also worked with better results.

In the Bhowanipur Asylum, containing European and Eurasian patients only, the inmates during 1898 numbered 53, against 55 in the previous year. Of this number 35 were under detention at the beginning of the year, and 18 were subsequently admitted. In the course of the year 4 patients were discharged cured, 9 were transferred to the care of friends, and 2 died, leaving 35 under confinement at the close of the year. As regards the health of the patients during the year, there were only 5 admissions to hospital, and 2 deaths.

North-Western Provinces and Oudh.

The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the North-Western Provinces and Oudh in 1898 numbered 1,290, including 206 fresh admissions during the year, against 1,334 in 1897. Before the close of the year 173 patients were discharged, of whom 134 were reported as cured, 39 were made over to friends, and 87

died, leaving 1,030 under treatment at the end of the year. The health of the asylum population showed no improvement, and the 87 deaths which occurred yielded a somewhat higher death-rate on the reduced population, viz., 82·6 per 1,000 of average strength, against 78·4 in 1897. The scheme for a large central institution at Agra, under the charge of a whole-time Superintendent, was still under consideration at the close of the year. It is stated, however, that "administrative sanction to the project at an estimated cost of about £21,000 has been accorded, and definite proposals about the staff are now being matured."

Punjab. The total number of lunatics in the Lahore and Delhi lunatic asylums in the Punjab during 1898 was 558, including 170 fresh admissions, against 526 in 1897. These figures are the highest on record, but the increase is thought to be due to greater readiness on the part of magistrates to grant admission orders, and to greater willingness on the part of friends to place patients under restraint, and not to any general increase of insanity in the province. At the end of the year the number was reduced to 424 by the discharge of 94 patients (55 as cured, 24 made over to friends, and 15 otherwise discharged) and 40 deaths. In both asylums there was less sickness among the inmates than in the previous year, but the mortality was much higher. The total number of hospital cases was 470. In Lahore the cases fell from 498 in 1897 to 423, and the deaths rose from 21 or 81·5 per 1,000 of daily average strength to 26 or 90·8 In the Delhi Asylum the deaths numbered 14 or 107·1 per 1,000, against 11 or 85·8 in 1897. No special diseases were present in any unusual degree, except pneumonia at Lahore, the cases having risen from 3 to 21. Unusual cold is supposed to have been the cause of this increase, as almost all the other circumstances were identical in both years. In the Delhi Asylum, on the other hand, pneumonia cases fell from 10 to 4.

Burma. The Rangoon Asylum is the only one in the province of Burma. Until the year 1894 a number of lunatics were, for want of accommodation, confined and treated in the Rangoon central jail. The asylum has since been twice extended, and there is now accommodation for 404 insanes. During 1898 there were 430 patients in the Rangoon Asylum, including 88 fresh admissions, and the total was reduced at the close of the year to 345 by the discharge of 44 patients for different causes, and the death of 41. The daily average sick was higher than in 1897, and the admissions to hospital rose from 139 to 173. No epidemic disease occurred among the patients, but the deaths rose from 36 or 108·0 per 1,000 of average strength to 41 or 119·2. More than half (22) of the inmates who died were in bad or indifferent health at the time of admission to the asylum. Of the 430 insanes 196 were criminal lunatics, and among them were 12 deaths, equal to 61·2 per 1,000 of average strength, as compared with 29 or 123·9 among civil lunatics, the high mortality among the latter being attributed to their general bad state of health on admission, some having died a few days after admission, and 13 within less than six months.

Central Provinces. In the two asylums of the Central Provinces (Nagpur and Jubbulpore), there were 384 lunatics under treatment during 1898, an increase of two on the number in 1897. In the course of the year 34 patients were discharged as cured or otherwise, and 24 died, leaving 326 still under treatment at the end of the year. The admissions to hospital at Nagpur rose from 59 to 205, but at Jubbulpore they fell from 108 to 100. The chief causes of sickness were influenza of a mild form (which was confined to the Nagpur Asylum, causing 129 admissions), fevers, dysentery, debility, and bronchitis. Of the total 24 deaths, Nagpur recorded 17, being in the ratio of 104·6 per 1,000 of average strength, against 14 or 83·7 in 1897. Nine of the 17 deaths in this asylum were due to dysentery and debility. At Jubbulpore there were 7 deaths, being in the ratio of 45·8 per 1,000, against 13 or 86·2 in 1897.

Assam. There is only one lunatic asylum in the province of Assam. This is situated in Tezpur, and the building is reported to be at present large enough for all demands on it. The total number of lunatics under treatment in the asylum during 1898 was 147, or six less than in the previous year. Of these, 29 were fresh admissions. At the close of the year the patients in the asylum were reduced to 125, 17 of the total number having been discharged, and 5 died. The health of the inmates was very satisfactory, being partly due to the salubrity of the year in the district; and the mortality was lower. Among the 147 inmates 86 were admitted to hospital, as compared with 92 in 1897. The number of deaths was less by five than in 1897, and the death-rate fell from 81·6 per 1,000 of average strength to 40·3.

Madras. At the commencement of 1898 there were 580 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During

the year 134 fresh cases were admitted, bringing the total population up to 714, or 28 less than the number in the preceding year. In the course of 1898 there were 91 cases of discharge, and of these 75 were cured or improved. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. On the whole there was less sickness among the patients than in the previous year; the daily average sick fell from 78 to 75, and the deaths from 59 or 100·5 per 1,000 of average daily strength, to 46 or 79·3. Beyond an outbreak of chicken-pox in the Madras Asylum, from which there were no deaths, all three asylums were free from epidemics. Of the total 46 deaths the Madras Asylum contributed 32, giving a death-rate of 75·2 per 1,000 on an average strength of 426, against a ratio of 87·8 in 1897. The death-rates of the other two asylums, Vizagapatam and Calicut, were 82·7 and 97·2 per 1,000 respectively, against 14·0 and 223·4 in the previous year. The increase in the mortality in the Vizagapatam Asylum was due to unavoidable causes. Of the six deaths in this asylum two were cases of chronic mania, and two others were paralytic.

Bombay

The total population of the six lunatic asylums of the Bombay Presidency (Colaba, Ratnagiri, Poona, Dharwar, Ahmedabad, and Sir Cowasji Jehangir, Hyderabad) was 1,043, including 282 fresh admissions, against 1,029 in 1897. In the course of the year 175 patients were discharged, 80 of them as cured, and 55 died, leaving 811 under treatment at the close of the year. There was slightly less sickness in the asylums than in 1897, the daily average sick having decreased from 49 to 41, the deaths also fell from 81 or 105·9 per 1,000 of average strength, to 55 or 69·9. Of the 55 deaths, 9 were due to dysentery, 8 to phthisis, 7 to diarrhœa, 4 each to debility and Bright's disease, and 5 to anæmia. The death-rate was lower in all the asylums. The Poona Asylum recorded the highest mortality, viz., 70·4, but this was nearly 15 per 1,000 lower than the ratio of 1897.

Medical Schools.

Bengal.

The number of medical schools open in Bengal during 1898–99 was 11. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided—two being schools of homœopathy. The college is affiliated to the University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the six unaided schools follow their own standards for private practice. The total number of pupils attending the various medical schools in the province was 1,709, as compared with 1,815 in the previous year.

The number of students at the Calcutta Medical College at the beginning of the session in 1898–99 was 576 (including 14 women), against 583 in the preceding year. As regards the examinations, 217 candidates were successful out of a total of 445 (including 4 women), the successes being at the rate of 49 per cent., as compared with 44 per cent. in 1897–98. Of the 217 successful candidates, 37 (including one woman) passed the Preliminary Scientific L.M.S. examination, 90 passed the first, and 51 (including two women) the second L.M.S. examinations; 25 passed the Preliminary Scientific M.B. examination; nine passed the first and three the second M.B. examinations; seven native dais passed in midwifery from the Eden Hospital, and received certificates of qualification, and 17 pupil nurses also passed as midwives.

The Campbell Medical School had 202 pupils (including 17 women) on its rolls at the end of the session. Of this number 27 males and 3 women passed the final examination for the diploma.

At the Dacca Medical School there were 144 pupils on the rolls (including 8 women). Fourteen students passed the final examination.

The Temple Medical School, Patna, had 115 students (including 2 women) on its rolls at the end of the session. At the final examination 3 candidates passed.

At the Cuttack Medical School the number of pupils at the close of the session was 104 (including six women). All the 13 candidates that appeared at the final examination passed.

North-Western Provinces and Oudh

The number of pupils attending the Agra Medical School in 1898–99 was 258 (including 63 women), or one more than in the preceding year. The results of the final examination of male students show that 45 out of 65 candidates passed. Eleven of the 15 military students in this class passed, and 29 of the 41 civil students passed. Of the students in Class II., comprising second-year military and third-year civil, private, and Rajputana pupils, 9 out of 12 military pupils and 21 out of 24 civil pupils passed the first half professional examination.

As regards women students, the examination results show a slight falling off. Six obtained their diplomas ; 7 out of 11 students in Class I. passed the final examination, and 9 out of 11 in Class II. or third year students were promoted.

Punjab. The average attendance at the Lahore Medical College and School was somewhat larger than in 1897–98, viz., 443 against 415. Of these 212 (including 8 women) were in the College, and 231 (including 3 women) in the Medical School. It was thought that the introduction of a higher qualification in general education as a condition of admission would have been the means of decreasing the number of college students, as in the previous year there was a falling off of 37 ; the effect, however, was only temporary, as the attendance rose from 210 to 212. The results of the year's examinations show that for the Preliminary Scientific Examination, held for the first time, 18 out of 20 candidates passed. In the first L.M.S. and M.B. examinations, 32 candidates out of 66 passed against 22 out of 66 in the previous year, and in the second L.M.S. and M.B. examinations 21 out of 52 passed against 16 out of 37.

In 1894 a medical school for women, called the North India Medical School for Christian Women, was opened at Ludhiana. The object of the institution is " to provide a thorough " medical training, under fully qualified Christian women, for those Christian women and " girls who wish to prepare themselves for medical mission work." At the end of 1898 there were 26 students on the rolls, or 6 more than in the previous year, and they were reported to be making satisfactory progress. Besides these 12 others were under training as dais. The students were this year recognised as eligible for admission to the examination for Hospital Assistants.

Madras. The number of students at the Madras Medical College (including the School Department) during 1898–99 was 456, including 35 women students. In the Hospital Assistant Department, consisting of 190 pupils, 68 appeared for the final examination, of whom 55 passed. The results of the several University examinations were again satisfactory, 26 having passed out of 57 candidates entered, against 32 out of 63. In the College Department there were, as in the previous year, 53 regular students reading for the M.B. and C.M. degree, 12 reading for the L.M.S. degree, and 17 casual students.

The Board Medical School at Nellore having been closed, the only other medical school at work during the year was the Prince of Wales' Medical School, Tanjore. At this there were 50 pupils on the rolls, all of whom were being prepared for the Hospital Assistants' Certificate. Twenty-one candidates appeared for the final examination and 14 passed.

Bombay. The attendance at the Grant Medical College, Bombay, rose from 320 in 1897–98 to 340 (including 24 women) in 1898–99. For the first University examination in medicine 130 candidates presented themselves, of whom 52 qualified ; and for the second examination in medicine 27 passed out of 69 candidates. For the final examination for the degree of L.M.S there were 54 candidates, and of these 20 passed, 2 qualifying in the first and 18 in the second class. There were 29 military medical pupils, of whom several were engaged on plague duty during their regular course of study, and were therefore allowed to continue in the College for a further period of six months before final examination.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The number of students was 269, and the results of the examinations were satisfactory.

VII.—SANITATION.

In Calcutta progress continued to be made in the improvement of bustees, or clusters of Native huts. In the matter of water supply there is nothing to record but the ordinary progress of the existing system. The average daily consumption of filtered water was 20,684,000 gallons, equal to 34 gallons per head of population for the town proper, and 20 gallons for the suburban area. In the course of the year the distribution pipes were slightly extended, bringing the total length up to a little over 315 miles, and the total number of premises connected had reached 28,343. The consumption of unfiltered water was 4,779,000 gallons, or 12 per cent. less than in the previous year; the daily consumption per head of population was about 11 gallons. Extensive improvements in the sewage and storm water outfalls of the town and suburbs, and the provision of a system of sewers for the suburbs were in hand. At the close of the year (1898–99) the total length of public sewers was over 209¼ miles, and the number of premises connected with them was 30,168, of which 320 connections were made during the year. During the year the conservancy of the port of Calcutta was maintained in a good state. **Bengal.**

The total amount spent on sanitary works in the municipalities of the interior of Bengal was *£130,000, or 46 per cent. of their income, a decrease of £5,500 on the sum expended in the previous year. In addition, a further sum of £32,400 was contributed by private individuals for the same purpose, against £77,850 in the previous year. The most important works were the completion of a portion of the Champanagar and Nathnagar extension of the filtered water supply of Bhagalpur, the Berhampore water supply, and the extension of that of Cossipur-Chitpur. A drainage scheme for the latter municipality and one for Maniktola were under consideration, and the Krishnagar scheme had been adopted. The Howrah scheme, which was prepared by the engineer of the Calcutta Corporation, was found too expensive, and has fallen through.

The Sanitary Board were unable to hold more than one meeting during the year. They were, however, enabled by circulation of papers to undertake the usual consultative work. Among other important matters, they considered the water-supply projects in respect to Howrah (extension), Darjeeling, and other places, and drainage projects for Krishnagar, Monghyr, Comilla, Siwan, and elsewhere. The Board was specially engaged in discussing the Monghyr drainage scheme and the scheme for giving a water-supply to the municipalities on the right bank of the river Hooghly. The towns in which drainage schemes have been carried out numbered 16, exclusive of Calcutta, and nine towns have improved water-supply.

In the North-Western Provinces and Oudh, many sanitary improvements have been effected in the urban areas, especially in the large cities. The municipalities expended during 1898 nearly 40 per cent. of their income on water-supply, drainage, and conservancy. Eight towns, Agra, Allahabad, Benares, Cawnpore, Lucknow, Meerut, Mussoorie, and Naini Tal are now furnished with waterworks and pumping machinery, which give daily a quantity varying from 10¾ gallons per head of the population in Naini Tal, to 3½ gallons at Lucknow, and the reports of the Sanitary Board show that the quality of the water supplied is satisfactory. Progress was made with the Benares sewerage works, and a small amount was spent on sewerage at Mussoorie; the water-supply works at Allahabad were continued; at Naini Tal a water-supply scheme costing £17,000 was sanctioned in March, 1898, and the greater part of the work had been done by the end of the year. The comparative absence of epidemic disease, the extinction of plague, and the amelioration of the general health, combined with improvement in municipal sanitation, make the record of the year a satisfactory one. Orders were issued prescribing the maintenance of a village sanitation book in towns and villages for recording the need of local sanitation. **North-Western Provinces and Oudh.**

The Sanitary Board held three meetings during the year, when they made certain recommendations as to the examination of the water-supply of towns. Their attention was also directed to the insanitary condition of the town of Kosi, in Meerut district, owing to its high death-rate in the autumn of 1897. Improvements since effected are reported to have considerably reduced the mortality at Kosi.

In the Punjab the municipal towns spent nearly 25 per cent. of their income on sanitary work in the year 1898. Much was done to improve the sanitary state of many towns. Water-supply or drainage works were either completed, in progress, or under **Punjab.**

* Throughout this Report income and expenditure are shown in pounds, rupees being converted for the purpose at the rate of Rs. 15 = £1.

consideration in 15 of the most important towns. Of the water-supply works in progress the chief were two reservoirs at Simla, a water-supply for Haripur, which was completed, and preliminary work for a water-supply at Amritsar. Important works were under consideration in Bhiwani, Delhi, and Simla. The chief drainage works in progress were those at Delhi, Lahore, Mooltan, and Rawalpindi; projects were in course of preparation for Umballa, Jagraon, Ferozepore, and Fazilka. Some of these schemes are of considerable magnitude, the estimated cost of the Delhi drainage works now in progress being no less than £40,600; but no very large amount was spent during the year on any one project. Private individuals also spent sums aggregating £4,500 on the construction of minor sanitary works during the year 1898–99. The health statistics of the towns, as might be expected, show, with few exceptions, a marked improvement after the introduction of water-supply, especially after enough time has elapsed to enable the people to get over their prejudice in favour of well water as against pipe water.

No meeting of the Sanitary Board was held during the year, but papers connected with sanitation were circulated among the members.

Burma. The appointment of a sanitary engineer for Burma will, it is hoped, stimulate sanitary works in the towns of the province. He has already made progress in the elaboration of schemes for the improvement of the water-supply of Moulmein, Mandalay, Bassein, Meiktila, and Kengtung, and examined a drainage scheme for Prome town. The question of the extension of the Rangoon water-supply was still receiving attention. No original sanitary work of any magnitude was completed during the year. Twenty-two lakhs (£147,000), or about one-third of the income of the various funds, was expended on sanitary works, including the cost of the large reclamation schemes in Rangoon. It is considered that the proportion of income spent on sanitation in some towns, noticeably in the larger municipalities, might well be raised. The total spent in the municipalities, other than Rangoon, on conservancy rose from £22,000 to £24,000 the improvement being largely due to the introduction of better methods of disposal of nightsoil in the larger towns of Lower Burma.

The Sanitary Board, it is reported, did practically no work during the year.

Central Provinces. The municipalities in the Central Provinces expended 22 per cent. of their income on conservancy, drainage, and waterworks in the year 1898. The water-supply works in Jubbulpore and Khandwa were advanced, and those in Wardha and Bhandara were completed; progress was also made with the drainage of Jubbulpore. The Harda waterworks scheme was again in abeyance, owing to want of funds. No new villages were brought under the Village Sanitation Act during the year; the Act had been extended to 43 villages in previous years, and it is generally reported to work well. Village inspection notebooks have been started in all districts, but little was done towards keeping them up. The principle on which sanitary improvements in villages are undertaken is that the greater part of the burden should be borne by the village itself by cash contribution or by free labour. In 1898 both money and labour were scarce.

Assam. Excluding the towns of Hailakandi, Sunamganj, Karimganj, and Maulvibazar, which have no separate incomes of their own, the municipal authorities in Assam spent 46 per cent. of their income on sanitation, including expenditure on roads and bridges; excluding these items the amount spent on sanitation proper was equal to 43 per cent. of income. No extensive sanitary work was undertaken during the year, but the waterworks at Gauhati and Shillong, which suffered from the earthquake in 1897, were still under repair. The sanitary improvements effected in rural tracts consisted chiefly in the construction of masonry wells and the excavation and deepening of tanks at some of the larger villages. Sanitary inspection books were kept up in selected villages.

No meeting of the Sanitary Board was held during the year, but the opinions of members were obtained when any important sanitary question was under discussion.

Madras. In the Madras Presidency the municipal councils spent 54 per cent., and the district boards 6½ per cent., of their income for sanitary purposes, exclusive of plague measures. A large portion of this expenditure was on conservancy, but the expenditure out of income on water-supply altogether amounted to £17,000 in addition to that of Madras city. The water-supply schemes of Coconada, Tirupati, and Vizagapatam were in progress during the year, as was also the extension of the waterworks at Conjeeveram. The only drainage work of importance under execution during the year was the realignment of the intercepting sewer at Ootacamund. A decided advance was made in the matter of conservancy, and a large staff was maintained for scavengering. Village sanitary inspection report books were in use in all unions in 19 out of the 22 districts of the Presidency, the exceptions being Malabar, Anantapur, and Tanjore.

The Sanitary Engineering Department completed surveys for water-supply or drainage for three municipalities, and one scheme was still under consideration. Three estimates were submitted to the Sanitary Board, the most important being the water-supply scheme for Vizianagram, estimated to cost £19,000, and another for Bezwada, to cost £25,000. In addition to these, many other small projects were in execution or projected.

The Sanitary Board scrutinized, during the year, plans and estimates for 36 municipal and 78 local fund works, estimated to cost £32,600; they also examined and laid before Government schemes for the water-supply of Vizianagram, for the extension of the waterworks at Kurnool and Tanjore, and for the drainage of a portion of the town of Kumbakonam, besides proposals in connection with 19 other schemes.

In connection with the sanitation of Madras City several useful improvements were being carried out. The underground sewerage system was completed in Mylapore, this marking the first stage of the scheme for the drainage of the whole city; the laying of water pipes was continued. The total quantity of water supplied to the town was nearly 4 per cent. in excess of that of the previous year, but the analysis of the water showed that there was an increase in both free and albuminoid ammonia, which rendered it suspicious for drinking purposes.

Bombay.

In Bombay Presidency the municipalities allotted over 49 per cent. of their income for sanitary purposes, and the local boards 18½ per cent., though in neither case was the full allotment spent. The whole expenditure on sanitary purposes was £194,000, of which about a third was spent on improvement of water-supply, and rather more on conservancy. The large expenditure on plague precautions checked the prosecution of sanitary works. Some progress was made at Hyderabad, Yeola, Kirkee, and Akalkot in water-supply schemes, but elsewhere much needed projects in this direction had to be suspended; and the same may be said of drainage schemes. The Bombay Village Sanitation Act was introduced in 17 villages during 1898, making a total of 299 villages which have been brought under it since it was passed in 1889; while village sanitary inspection books have now been introduced into 3,199 villages, though little progress has been made in filling them up, owing to the disorganisation of ordinary sanitary work on account of plague. The Act provides for the establishment of a sanitary committee or a sanitary board, consisting of members chosen by the collector of the district, or by the Local Government, to supervise sanitary matters. Several committees have now been established, some being supported by local rates or voluntary contributions supplemented by Government and local fund grants.

In Bombay City 20 drainage works were in progress, several of which have been practically finished; on the Mazagon sewerage works over £18,000 had been spent up to date; £25,000 was spent during the year on the sewerage of Parel and other districts, chiefly in the purchase of machinery. Most of the other schemes were of considerable importance. The Shone system of sewerage at Colaba continued to work satisfactorily. The Corporation, having been unable to come to a decision on the surface and subsoil drainage scheme, had referred the whole question for advice and report to Mr. W. Santo Crimp. The waterworks were efficiently maintained throughout the year.

The Sanitary Board gave advice concerning several projects, including the waterworks at Kaira, Mehmadabad, Ahmednagar, and Belgaum, and drainage schemes for Poona City and Ahmedabad.

Berar.

The municipalities of Berar spent 50·7 per cent. and the district boards about 11 per cent. of their income on sanitary improvement, the proportion being in either case smaller than in 1897; but the amount in that year was swollen abnormally by expenditure more or less directly connected with famine relief. No new works of any great importance were undertaken during the year. The sanitary survey of selected towns and large villages made better progress, the stress of famine relief having been removed. The number of towns now surveyed is 37, and of villages 1,009, leaving two towns and 4,234 villages still to be surveyed. Village sanitary inspection books have been introduced in five selected areas in each district of the province, and it is hoped that the information thus recorded will be put to some practical use in future.

W. T. Ronson.

India Office,
October, 1900.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1898.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1898.

(*Surgeon-General Robert Harvey, M.D., C.B.*)

European Troops.

Sickness and mortality in 1898.

THE health of the European army of India was much better in 1898 than in the preceding year, though the constantly sick and death rates were still high as compared with the ratios of the decennium. The improvement is apparently connected with the fact that the progression of the seasons had become more normal. The dry parts of the year were somewhat quieter, hotter, and dryer than usual, and over the greater part of India the monsoon rain was above rather than below the normal. That the invaliding ratio was high, mostly from ague, and that sickness and mortality did not fall to the mean of recent years, were probably due to the sequelæ of the malaria of the previous year and to the after-effects of field service.

YEAR.	Strength.	RATIO PER 1,000 OF STRENGTH.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	TOTAL LOSS.
1886–95	677,877	1,457	83	15·16	24	39
1897	68,395	1,557	101	22·93	33	56
1898	67,741	1,437	90	20·05	38	58

The chief causes of admission were ague and venereal diseases. Among the diseases with increased admission rates were influenza, remittent fever, enteric fever, and hepatic abscess. On the other hand, the admission rates from cholera, small-pox, venereal diseases, dysentery, and diarrhœa were lessened. Ague caused 27 per cent. of the total sickness, and venereal diseases 25 per cent.

The chief causes of death were enteric fever, hepatic abscess, and heatstroke. Among the diseases with increased mortality were simple continued fever, heatstroke, respiratory diseases, tubercle of the lungs, enteric fever, and hepatic abscess. On the other hand, the mortality from cholera, small-pox, dysentery, diarrhœa, and malarial fevers was lessened. Enteric fever caused 51 per cent. of the total deaths, hepatic abscess 8 per cent., heatstroke 6 per cent., and dysentery 4 per cent.

The chief causes of invaliding were, in order, syphilis and gonorrhœa, malarial fevers, debility, dysentery, disordered action of the heart, and tubercle of the lungs; syphilis and gonorrhœa, and malarial fevers, being far ahead of the others.

In the following table the ratios of the four commands are placed side by side for comparison. Bengal had the highest mortality from tubercle of the lungs and from hepatic abscess, and the lowest from remittent fever and from pneumonia; the Punjab the highest from cholera, enteric fever, malarial fevers, heatstroke, pneumonia, other respiratory diseases, and dysentery; Madras the lowest from enteric fever, ague, tubercle of the lungs, respiratory diseases, dysentery, and hepatic abscess. The percentage of enteric fever in total deaths was highest in Bombay; of pneumonia in the Punjab; of dysentery and hepatic abscess in Madras. The total death rate of Madras, which was the lowest, only reached 31 per cent. of the height of that of the Punjab, which was the highest. Bengal had the highest constantly sick rate, the Punjab the highest admission and death-rates;

and the Punjab was the only command less healthy than in 1897, the others being more healthy.

Ratios of Commands.

	Ratio per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.
I.—Strength	20,060	18,388	12,337	14,612	67,741
II.—Constantly Sick Rate of each Month.	96·2	89·8	89·2	85·7	90·0
III.—Admission Rate :					
Influenza	5·2	·8	30·1	5·1	8·3
Cholera...	·2	·6	·2	—	·3
Small-pox	—	·1	·1	—	·3
Enteric fever	41·1	48·7	11·6	35·1	36·9
Intermittent fever	423·3	515·9	202·1	394·3	394·0
Remittent fever	10·6	86·0	15·6	11·2	32·9
Simple continued fever	38·4	47·0	46·8	44·8	42·5
Tubercle of the lungs	3·5	2·0	2·1	4·4	3·0
Pneumonia	1·8	4·8	1·2	3·8	3·3
Other respiratory diseases	19·7	30·8	24·0	26·6	26·0
Dysentery	33·9	27·8	32·3	24·4	29·8
Diarrhœa	22·5	39·5	5·1	30·1	27·3
Hepatic abscess	3·1	1·8	2·3	2·4	2·4
,, congestion and inflammation	20·4	14·4	27·1	15·4	18·6
Venereal diseases	437·9	268·9	438·3	352·5	362·9
All Causes	1,483·5	1,558·0	1,292·6	1,420·0	1,436·9
IV.—Death Rate :					
Cholera...	·15	·54	·08	—	·21
Small-pox	—	—	—	—	—
Enteric fever	10·47	14·74	2·27	9·92	10·17
Intermittent fever	·30	·44	·16	·21	·30
Remittent fever	·10	·76	·24	·34	·37
Simple continued fever	—	·11	.08	—	·06
Heatstroke	1·15	2·45	·41	·41	1·17
Circulatory diseases	·15	·60	·73	·55	·47
Tubercle of the lungs	·75	·65	·08	·68	·58
Pneumonia	·23	1·25	·24	·48	·61
Other respiratory diseases	·15	·22	—	·14	·16
Dysentery	·85	1·03	·49	·62	·78
Diarrhœa	—	·05	—	·07	·04
Hepatic abscess	2·09	1·25	1·13	1·57	1·52
All Causes	19·54	27·63	8·59	18·20	20·05

Burma.—The following table gives vital statistics of the European troops in Burma as a whole, whereas the table on the opposite page contrasts Burma Coast with Burma Inland. The ratios of 1898 are the lowest in the table. Burma in 1898 was distinguished by the prevalence of simple continued fever and venereal diseases :—

Period.	Strength.	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths from		
				Cholera.	Other causes.	Total.
1890	4,712	1,743	102	—	20·80	20·80
1891	4,623	1,589	92	2·38	17·74	20·12
1892	4,316	1,491	91	—	14·83	14·83
1893	3,928	1,461	96	·25	12·73	12·98
1894	3,940	1,465	93	·25	9·39	9·64
1895	4,045	1,410	96	·99	8·41	9·39
1896	4,174	1,514	109	·48	6·71	7·19
1897	4,060	1,467	107	—	10·84	10·84
1898	4,069	1,167	79	—	6·39	6·39

Field Forces.—Of the forces which were on field service in 1898, the Malakand Field Force was broken up on the 22nd January, 1898, and out of it was formed the Malakand Force; the Tirah Field Force was broken up on the 9th April, and out of it was formed what was called at one time the Khyber Force and at another the Khyber Brigade. The health of the Tirah Field Force was better than in the preceding year. Adding together for 1898 the Field Forces and the forces by which they were succeeded, it is found that health in 1898 was better than in 1897. The Tirah Field Force, the Khyber Force, and the Malakand Force suffered heavily from enteric fever.

Geographical Groups.—The following table shows that, judging by the constantly sick rate, Burma Inland and Gangetic Plain were the most unhealthy groups for the decennium, and Hills and Deccan the most healthy. It also shows that the 1898 constantly sick rate of every group, except the first three, was higher than its corresponding decennial ratio, and that the rise was greatest in the case of the Deccan, Central India, and Indus Valley groups. As compared with the decennial ratios, there was increase of cholera mortality only in Bengal-Orissa, absence of cholera mortality, as usual, in Western Coast, and reduction in all other groups; while there was decrease of enteric fever mortality in Groups I., II., IV., X., and XII*b*., and increase in all the others, the mortality being greatest in Groups XII*a*., VII., V., and VIII.

		Ratio per 1,000 of Strength.												
		I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
		Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
1886-95	Constantly sick ...	89·0	99·4	92·9	96·0	88·9	83·9	88·0	79·1	81·7	82·2	70·9	88·0	82·6
	Death—Cholera ...	·21	1·71	·78	4·31	1·14	1·13	1·65	·74	—	·30	·61	·78	1·33
	Death—Enteric fever	3·02	2·47	3·13	5·98	7·03	5·30	7·00	4·69	2·14	2·79	5·56	4·98	5·28
1897	Constantly sick ...	117·2	105·8	95·4	107·9	99·8	103·8	127·7	100·5	76·9	93·9	98·4	88·4	101·4
	Death—Cholera ...	—	—	·88	6·59	·15	·20	2·60	·56	—	—	—	—	1·17
	Death—Enteric fever	6·66	1·12	·44	10·24	9·77	12·64	20·16	6·43	3·40	5·67	8·36	3·17	9·01
1898	Constantly sick ...	86·4	78·6	80·8	102·4	95·3	95·2	99·1	97·7	82·7	86·8	77·9	95·6	90·0
	Death—Cholera ...	—	—	·84	·15	·78	—	—	—	—	·28	—	—	·21
	Death—Enteric fever	·82	·75	2·94	13·61	11·21	13·93	14·31	5·45	·66	3·12	14·30	3·48	10·17

In the following table the vital statistics of the groups for 1898 will be found placed side by side to facilitate comparison. Gangetic Plain had the highest constantly sick rate, and Indus Valley the highest admission and death rates; Hills the lowest constantly sick rate, Western Coast the lowest admission rate, and Burma Coast the lowest death rate. Burma Coast had the highest admission rate from simple continued fever and small-pox, and the lowest from ague; Burma Inland the lowest from tubercle of the lungs and from respiratory diseases other than pneumonia; Bengal-Orissa the highest from dysentery and hepatic abscess; Gangetic Plain the highest from tubercle of the lungs and venereal diseases; Upper Sub-Himalaya the highest from cholera; Indus Valley the highest from ague, remittent fever, pneumonia, and other respiratory diseases, and the lowest from simple continued fever and venereal diseases; Deccan the highest from influenza; Western Coast the lowest from enteric fever and hepatic affections, and nearly the lowest from ague; Southern India the highest from congestion and inflammation of the liver, and the lowest from diarrhœa; Hill Stations the highest from enteric fever and rheumatic fever, and the lowest from dysentery.

Ratios of Geographical Groups.

	Ratios per 1,000 of the Average Strength.												
	I. Burma Coast and Bay Islands.	II. Burma Inland.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XIIa. Hill Stations.	XIIb. Hill Convalescent Depôts and Sanitaria.	India.
I.—Strength	1,226	2,654	2,381	6,686	12,751	4,737	6,011	8,256	1,522	3,520	7,625	3,160	67,741
II.—Constantly Sick Rate of the Year.	86·4	78·6	80·8	102·4	95·3	95·2	99·1	97·7	82·7	86·8	77·9	95·6	90·0
III.—Admission Rate:													
Influenza	·8	7·2	1·7	7·3	·1	—	7·2	43·6	—	8·5	2·0	12·3	8·3
Cholera	—	—	·8	·3	·9	—	—	—	—	·6	—	—	·3
Small-pox	·8	—	—	—	·1	—	—	—	—	—	—	—	—
Enteric fever	7·3	4·5	19·3	44·1	36·6	29·6	47·1	25·7	2·6	19·3	59·7	20·3	36·9
Intermittent fever	56·3	171·4	603·5	314·8	550·3	766·3	499·1	320·6	115·0	278·1	224·8	443·0	394·0
Remittent fever	8·2	30·5	1·3	11·1	12·2	237·5	14·6	8·8	11·8	22·7	11·4	3·2	32·9
Simple continued fever ..	88·9	52·0	19·3	63·3	47·5	4·6	34·9	49·9	67·7	68·5	34·6	15·2	42·5
Rheumatic fever	—	1·5	·8	·4	1·6	·8	1·2	1·2	1·3	·9	2·8	1·9	1·5
Tubercle of the lungs ..	1·6	1·1	2·1	3·4	2·9	2·5	3·0	2·1	2·6	2·3	1·3	2·8	3·0
Pneumonia	—	1·1	1·7	1·2	3·5	7·6	3·0	·8	3·9	·9	5·4	3·8	3·3
Other respiratory diseases	14·7	13·6	21·4	17·1	31·0	35·9	28·3	26·8	28·3	20·2	20·7	35·4	26·0
Dysentery	31·8	29·0	67·6	34·3	28·5	24·1	25·5	28·3	18·4	29·3	16·9	20·6	29·8
Diarrhœa	16·3	6·0	26·9	21·4	30·6	25·3	31·6	20·5	22·3	3·4	31·9	33·9	27·3
Hepatic abscess	2·4	2·6	5·9	2·8	2·2	1·9	2·0	2·1	1·3	2·0	1·8	2·5	2·4
Hepatic congestion and inflammation.	18·8	10·9	20·2	21·4	18·0	12·9	16·1	21·3	7·2	40·6	12·6	19·6	18·6
Venereal diseases	497·6	428·4	302·0	498·8	356·4	278·2	406·4	455·2	354·1	496·9	288·8	288·4	362·9
All Causes	1,168·0	1,197·4	1,444·8	1,425·5	1,622·4	1,890·0	1,612·4	1,447·2	1,092·6	1,488·4	1,139·3	1,432·6	1,436·9
IV.—Death Rate:													
Cholera	—	—	·84	·15	·78	—	—	—	—	·28	—	—	·21
Small-pox	—	—	—	—	—	—	—	—	—	—	—	—	—
Enteric fever	·82	·75	2·94	13·61	11·21	13·93	14·31	5·45	·66	3·12	14·30	3·48	10·17
Intermittent fever	—	—	·42	—	·47	·63	·33	·12	—	·28	·13	·63	·30
Remittent fever	—	·38	—	·15	·24	1·48	·33	—	—	·28	·39	·63	·37
Simple continued fever ..	—	—	—	—	·16	—	—	—	—	—	—	—	·06
Heatstroke	—	·33	·84	1·35	2·04	4·22	1·16	·12	·66	1·14	—	·32	1·17
Circulatory diseases ..	—	·38	·84	·15	·24	·63	·17	·85	·66	1·14	·26	·63	·47
Tubercle of the lungs ..	—	—	·84	·75	·71	·84	·33	·12	·66	·28	·52	·95	·58
Pneumonia	—	·38	·84	—	·78	2·11	·67	·12	·66	—	·52	·95	·61
Other respiratory diseases	—	—	—	·30	·08	—	—	—	·66	—	·39	—	·16
Dysentery	—	—	1·26	·60	1·02	·63	·50	1·09	·66	·57	·39	·95	·78
Diarrhœa	—	—	—	—	·08	—	—	—	—	—	—	—	·04
Hepatic Abscess	1·63	1·13	3·78	1·79	1·33	1·69	1·50	1·21	1·97	1·14	1·57	·95	1·52
All Causes	4·08	7·54	14·70	21·09	22·82	32·09	22·13	11·75	11·17	11·08	20·46	13·61	20·05

The percentage of enteric fever to total admissions in 1898 was greatest in Hill Stations; of ague in Bengal-Orissa and Indus Valley; of remittent fever in Indus Valley; of simple continued fever and venereal diseases in Burma Coast; of dysentery and hepatic abscess in Bengal-Orissa; of enteric fever, pneumonia, and diarrhœa in Hill Stations; and of other respiratory diseases in Western Coast.

Stations.—The highest ratios among the large garrisons with a strength of over 1,000 were those of Peshawar and Quetta (over 40), Lucknow (over 30), Umballa, Agra, and Rawalpindi (over 20); and all, except that of Agra, which was much reduced, were higher than the corresponding ratios of 1897. The greatest increase was in the case of Quetta, and was due especially to enteric fever, and in a less degree to malarial fevers, respiratory diseases, hepatic abscess, and dysentery. Lucknow also had a great increase of mortality from enteric fever; and Rawalpindi a great increase from abscess of the liver. Though the death ratio of Peshawar was highest of all, it showed the least increase over the ratio of 1897. Agra, Umballa, and Peshawar were also in this black list in last report. The health statistics of Umballa, Rawalpindi, and Peshawar are said by the medical officers to have been unfavourably affected by the return or reception of broken-down men from frontier field service; and at eight other stations the same complaint was made.

Regiments.—The statistics of individual regiments and of the different arms of the service show that the infantry had, as in the preceding three years, the highest admission and constantly sick rates; and the cavalry the highest death and invaliding rates. The highest constantly sick rate was in the 80th Battery, Field Artillery, at Jhansi; the highest among cavalry in the 5th Dragoon Guards at Meerut; and the highest among infantry in the 1st Battalion of the Bedfordshire Regiment at Meean Meer. The highest death rate was in the 2nd Battalion of the Yorkshire Regiment at Peshawar, and was due to enteric fever and heatstroke. The 2nd Battalion of the Oxford Light Infantry at Lundi Kotal and the 1st Battalion of the Wiltshire Regiment at Quetta had also high ratios due to enteric fever. The 9th Lancers at Muttra and the 25th Battery, Western Division, had the highest ratios (due to enteric fever) in their respective arms of the service.

Principal diseases: Influenza.—Sickness and mortality having been studied in their relation to India, to commands, to geographical groups, to stations, and to regiments, it will be convenient now to discuss the statistics of some of the chief diseases. At the end of 1897 and the beginning of 1898 influenza was falling. It began to rise again in February 1898, and reached its maximum for the year in April. There was very little in the second half of the year. The following table shows the increase of total in 1898. It also shows the monthly progress and the annual fluctuations of the disease since 1890, the first epidemic year:—

Period.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Per 1,000 of strength.
1890	—	3	473	1,451	248	69	13	2	3	—	—	1	2,263	33·4
1891	1	—	1	16	77	91	112	29	20	2	2	21	372	5·5
1892	113	53	354	241	57	4	32	8	—	—	—	—	862	12·7
1893	1	—	—	15	4	—	—	—	—	—	—	1	21	·3
1894	7	9	12	70	101	30	7	7	—	2	—	—	245	3·4
1895	14	7	52	156	66	35	17	1	5	13	23	165	554	7·8
1896	262	65	140	30	12	7	3	3	88	128	50	20	808	11·5
1897	12	10	31	9	11	30	8	8	—	54	87	12	272	4·0
1898	7	19	82	213	162	57	6	—	1	—	9	8	564	8·3
Total	417	166	1,145	2,201	738	323	198	58	117	199	171	228	5,961	

The actual maximum of the individual years of the nine occurred in various different months, but over the nine year period as a whole the greatest numbers of cases occurred in April and March, and the smallest numbers in August and September: 84 per cent. of the whole in the first six months of the year, and only 16 per cent. in the last six months. Geographical Groups I., II., V., VI., VIII., IX., XI., XII*a*., and XII*b*. were attacked

both in 1897 and in 1898 ; Group IV., which had escaped in 1897, was affected in 1898 ; Group VII. escaped in both years ; while Group X. was spared in both years, as well as in 1896, 1895, and 1894. It is not known why this last group, which contains the European garrison of Bombay, has been so long free from influenza. Twenty-five stations were attacked in 1898, against 12, 19 of them suffering only in 1898, and six in both years ; while six escaped that had been affected in 1897. Belgam, Ahmednagar, Sitapur, Wellington, and Secunderabad had the greatest numbers of cases. At some stations the beginning and the end of the outbreak were abrupt, at others more gradual ; but nowhere did two distinct outbreaks occur in the year. The average number of men constantly sick with influenza was 25, against 10 in 1897, and the average duration of a case 16 days, against 13. The returns deal, of course, only with those cases which were admitted into hospital. The only death returned as directly due to influenza occurred at Belgam. It is mentioned that at Belgam there were other cases besides those admitted to hospital. At page 74 is given a table showing the relation, year by year, of influenza to pneumonia, and of the influenza of the European troops to that of the native troops and to that of the prisoners. The influenza admission ratio of the first was the same as that of the second, much less than half that of the third. The likeness of some of the cases to dengue was noted at Barrackpore.

Cholera.—General questions regarding the etiology, spread, and prevention of cholera, and the circumstances, so far as they are of importance, attending the occurrence of cases of 1898, will be found discussed under Chief Diseases, page 94. The amount and proportion of cholera were much less than in the previous year, and the ratios were much below those of the decennium, as may be seen in the following table :—

Period.	Admissions.		Deaths.	
	Number.	Per 1,000 of strength.	Number.	Per 1,000 of strength.
1886–95	1,280	1·9	901	1·33
1897	117	1·7	80	1·17
1898	17	·3	14	·21

As regards the distribution of the cholera of 1898 by stations and seasons, the monthly maximum was only 11, and was reached in May ; and in no less than eight months of the year cholera was absent. Umballa with ten cases suffered most, seven of the cases occurring in the 3rd Battalion of the Rifle Brigade.

Small-pox.—The admission rate from small-pox was reduced from 0·4 to 0·03, and the death rate from 0·06 to 0·00. There were only 2 cases with no death against 24 cases with 4 deaths. The ratios were, of course, much below the decennial ratios of 1886-95. Rangoon and Sialkot had each one case, the former station belonging to Burma Coast and the latter to Upper Sub-Himalaya.

Ague, Remittent Fever, Simple Continued Fever, Malta Fever.—Ague gave rise to over 27 per cent. of the admissions from all causes. That the admission ratio did not fall more seems to have been largely due to relapses among those who had contracted the disease in the preceding year.

Period.	Intermittent Fever.		Remittent Fever.		Simple Continued Fever.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–95	353	·18	9	·54	57	·04
1897	395	·41	25	·60	43	·01
1898	394	·30	33	·37	43	.06

The ratios were above those for the decennium. In 1898 the ague ratios were high in ndus Valley, Bengal-Orissa, and Upper Sub-Himalaya, and low in Burma Coast, Western Coast, and Burma Inland. And that this is a usual state of things as regards the first, third, fourth, and fifth of those groups, may be seen from the following :—

Period.	Ratio per 1,000 of Strength.												
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
1886–95...	194·5	531·2	381·8	216·9	465·5	632·4	496·9	228·0	164·3	119·0	291·0	320·4	352·9
1897 ...	47·4	132·6	383·9	246·7	422·6	761·8	584·2	333·3	182·2	139·4	128·1	158·7	394·7
1898 ...	56·3	171·4	603·5	314·8	550·3	766·3	499·1	320·6	115·0	278·1	224·8	443·3	394·0

It will be observed that the high ratio of Bengal-Orissa is unusual. All the stations in the group participated in the increase. The medical officer of Barrackpore explains that a large proportion of the cases were relapses in men infected the previous year, and that the type of disease was milder than in 1897. The fever at Dum Dum is said to have been largely due to the receipt of infected men from Barrackpore; and with regard to Calcutta it is stated that there had been practically no cold weather, and that the damp fogs had been a prolific source of the disease in men weakened by the long-continued hot weather. At ten stations the original infection of men suffering in 1898 is said to have been contracted on field service. Proximity of irrigation canals was blamed at Kirkee. On the other hand, reduction of ague was at Kurrachee ascribed to the Indus having overflowed less than usual, and at Meiktila to the water having been boiled. Those officers who mention the prophylactic issue of quinine speak of it as having been beneficial.

The most malarious month of 1898 was November, and the least malarious February. A comparison of the figures for 1898 with those for 1897 supports the view that the malarial fever of 1898 was largely a product of the malaria of 1897, because the numbers of cases in the earlier months of 1898 were high, while those in the usually malarious months were low.

Morbidity from remittent fever increased in 1898, while mortality diminished. The disease was most prevalent at Peshawur and in the Khyber Force and Brigade. The geographical groups which showed the greatest increases were VII. and XI. The medical officer at Peshawur remarks that the remittent fever was mild, there being only 7 deaths in 1,116 cases, or a little over 0·6 per cent. The case-mortality for India was also only just over 1 per cent. Remittent fever in 1898 was most prevalent in May, and least prevalent in February. This distribution is not the same as in 1897, probably on account of the continuity of malarial action from 1897 into 1898; and this difference of distribution, therefore, supports the diagnosis of these remittents as malarial. The records of the *post morten* examinations also on the whole supports the diagnosis, though in one case ulceration of the large intestine with abscess of the liver was found, and in two others ulceration of the intestine unlike that of enteric fever.

The admission ratio from simple continued fever was slightly reduced, while the death ratio increased. It was most prevalent in Burma Coast, Southern India, and Western Coast. Four deaths were returned, and in the three *post mortem* records which have reached this office no definite lesions are described. The medical officer of Barrackpore complains that danger to the community is often caused by wrongly diagnosing mild cases of enteric fever as simple continued fever or ague. In the Cherat, Madras, Bellary, and Mandalay reports it is noticed that the relative numbers of cases of simple continued fever, ague, remittent fever, and, it might have been added, enteric fever, vary with a change of medical officer; and the medical officer of Bellary illustrates this by indicating his opinion that simple continued fever is no doubt of malarial origin.

Two cases of Malta fever were returned, one from Deolali and one from Nowshera. The patient at Deolali had come from Gibraltar. With regard to the case at Nowshera the medical officer says :—

> The patient, of the 1st Battalion of the Dorsetshire Regiment, was admitted on December 2nd, 1898, complaining of acute pain in left hip and knee. He arrived in India on November 18th, 1898, from Malta, where he had been 92 days in hospital with Mediterranean fever. Since then he had had slight recurrence of pain in his joints from time to time. The present illness started at Deolali, and he gradually got worse till admission. . . . . In view of the previous history the disease was diagnosed as Mediterranean fever.

Enteric Fever.

Since last report was written there has been no striking discovery in the domain of enteric fever etiology. Perhaps the points that have come most to the front are the results of the continued researches as to the infectivity of the fæces and urine, especially of the latter, and the insistence upon the reality and not altogether inconsiderable frequency of sick-room infection.

Fæces.—The general conclusions arrived at by Horton Smith from his examination of fæces are as follows : —

> The stools of a typhoid patient separated from the urine contain typhoid bacilli in fair quantities, demonstrable by our present methods up to about the beginning of the third week. After this date the number begins rapidly to diminish, so that our methods no longer avail as a rule to find them. If, however, a relapse occurs, it may be preceded by a recrudescence of the typhoid bacilli, which can then be found again in the fæces ; but during the greater part of the relapse itself and throughout convalescence the typhoid bacilli cannot be found in the stools. It follows from the above that the stools of a typhoid patient must always be regarded as highly infectious during the early stages of the disease, and may again become so in connection with the commencement of a relapse. This highly infectious character, however, soon becomes greatly diminished, though how soon the stools become absolutely harmless cannot as yet be settled by bacteriology. Finally, when typhoid bacilli have been described in the fæces long after defervescence—*e.g.*, in Lazarus's case, 41 days after—we are dealing almost certainly with fæces contaminated with urine, and not with pure fæces.

The results were obtained from the examination of 29 stools, three before the eighteenth day and 26 after, by a fully controlled Elsner method ; and the results of Pollak, Jemma, and Richardson, are also quoted ; all going to show that during the first two weeks of enteric fever, but, apparently, more often towards the end of the second week than earlier, the enteric bacillus can be demonstrated in the stools if sufficient care and trouble be taken. Of the 29, the only stool belonging to a later day of the disease than the seventeenth in which a positive result was obtained was one voided just before a relapse occurred. Some of the older findings of enteric bacilli at late periods of the disease or in convalescents were vitiated by the fact that no care was taken to obtain the fæces without admixture of urine, an excretion which, as will be seen hereafter, is apt to contain the bacillus at late periods. It is a fact that, *post-mortem*, enteric bacilli can often be found in the gall-bladder, even in pure culture, at a time when they can no longer be found in the fæces. Why in such cases they have not continued to appear in the fæces is not at present explicable.

Urine.—With regard to the urine, Horton Smith's general conclusions are :—

> (1) It can no longer be doubted that typhoid bacilli occur in the urine of typhoid patients, probably in about 25 per cent. of all cases. (2) For the most part, though present in such numbers as to be demonstrated bacteriologically with the greatest ease, they are not present in sufficient quantity to alter the naked-eye appearance of the urine. In a smaller proportion of cases, however,—probably about 5 per cent. of all typhoid cases—the urine is rendered turbid by their presence. They are nearly always in pure culture. (3) They occur first late in the disease, rarely, if ever, before the third week, and may make their first appearance during convalescence. (4) They generally remain present for some considerable time, for some weeks or even months. (5) The character of the urine does not assist in diagnosing the condition (unless, of course, it be rendered turbid by the bacilli). It may contain no albumin, often contains but a trace, sometimes has a good deal, and sometimes has pus ; all of which conditions occur quite apart from the presence of typhoid bacilli in the urine. (6) The prognosis of a case is not rendered more grave by the occurrence of this condition.

"The urine," continues Horton Smith, "must be regarded as highly infectious, and the same precautions should be taken with regard to it both during the disease and also during convalescence as have now for some years past been adopted in the case of the fæces." He then makes a strong appeal for the routine employment of urotropine after the method of Richardson. In the course of his paper he refers to his own previous work, and to that of Petruschky and of Richardson, papers by all of whom were referred to in last report. He agrees with Petruschky that the enormous excretion of enteric bacilli in the urine that occurs in some cases may be intermittent, and points out that it must therefore be due to some local change in the urinary tract, and not to a filtration of bacilli from the blood. As Opitz says, there is no physiological elimination of bacteria by the kidneys, and bacteria appear in the urine only when the vessel walls and the renal epithelium have

been injured. The appearance of the bacilli in the urine has not been observed earlier than the 15th day; but it is said that the urine may continue to contain bacilli for months or even years.

Richardson has published several papers on the subject. In one series he obtained a positive result in 9 patients out of 38 and in 44 specimens out of 172. When the bacilli were present at all, they were in large numbers and almost in pure culture. They did not appear until a late stage of the disease, and usually continued to be excreted up to late in convalescence; so that both during the disease and during convalescence the urine should be carefully disinfected. The presence of enteric bacilli was always accompanied by that of albumen and casts, although all urines with albumen and casts did not contain enteric bacilli. The earliest dates at which bacilli were found were the 15th and the 24th days of the disease, and in 5 out of the 7 patients who survived the bacilli were still present on discharge from hospital. In another series he had positive results in 7 out of 24 cases and in 26 out of 96 specimens, and the accompanying circumstances were the same as in the other series. The enormous numbers of bacilli present often caused cloudiness of the urine, and perhaps the bacilli may have multiplied in the bladder. In a third series of 66 cases he found the bacillus in the urine in 14, sometimes in enormous numbers. The bacilli can persist for weeks and months, and in one case they were found in the urine of a man who, since an attack of enteric fever five years before, had suffered from urinary trouble (probably specific enteric nephritis). As those who suffer or have suffered from enteric fever may remain so long dangerous, every patient should receive 30 grains of urotropine daily for 10 days as convalescence approaches, beginning with the third or fourth week.

Renal enteric fever is also spoken of; by which appears to be meant ambulant cases of enteric fever with renal symptoms, the diagnosis being made by the finding of the enteric bacillus in the urine.

Infectivity of Fæces and of Urine compared.—Horton Smith notices that whereas the fæces contain the bacilli in apparently every case, the urine is infective probably only in about 25 per cent. of cases; that typhoid stools are most dangerous within the first three weeks, while typhoid urine only becomes dangerous towards the end; that typhoid stools may contain considerable quantities of typhoid bacilli, but rarely, if ever, such myriads as may be present in the urine. He continues:—

In conclusion we may ask which excretion must be regarded as the more dangerous and chiefly responsible for spreading the disease. It would seem on the whole that the palm must be given to the urine, and this partly on account of the enormous number of bacilli which may occur in it, and partly on account of the nature of the excretion itself. Thus, the stools by their colour and odour at once attract attention, so that the slightest soiling of the linen is at once noticed, and the damage rectified. But the same cannot be said of the urine. A minute drop from a suitable case may contain some 6,000 bacilli adhering to the end of the penis or to the vulva after micturition. It would infect the linen, and could not but escape detection. It is probable, indeed, that in such cases we have the explanation of the fact that even after all precautions have been taken, those attending on typhoid patients not so very rarely catch the disease. It would seem in fact at the present moment that this occurrence must be sometimes unavoidable. Indeed, when we come to think of the matter, it is really astonishing, considering the opportunities of infection which undoubtedly exist, that these cases do not occur more often. It is a strong argument in support of the view that some other conditions must pre-exist, possibly in connexion with the bacterial flora of the alimentary canal, without which typhoid fever will not occur, even should the typhoid bacillus be introduced.

The danger to water-supplies of such infective urine has been pointed out by Petruschky and others. Kübler and Neufeld, from the circumstance that no colon bacilli accompanied the enteric bacillus in the water of a certain well, concluded that the contamination had more probably been effected by urine than by fæces. The presence of the colon bacillus in the water would not, however, have proved that the water had been infected by fæces and not by urine, because the presence of the colon bacillus has been reported in urines, as mentioned in reports of former years.

Sick-room infection.—In a careful paper read before the British Medical Association, Dr. Peck gave the following table to illustrate his experience as Medical Officer of Health of the Chesterfield Rural District:—

Soil infection	9	cases,	equal to	4·37	of	the	whole.		
Drain effluvia	21	„	„	10·20	„	„			
Pollution of water-course	9	„	„	4·37	„	„			
Manure	6	„	„	2·91	„	„			
Water	1	case	„	0·50	„	„			
Importation	25	cases	„	12·13	„	„			
Sick-room infection	28	„	„	13·50	„	„			
Several possible causes	69	„	„	33·50	„	„			
No ascertainable cause...	38	„	„	18·44	„	„			
TOTAL	206	cases							

His conclusions are :—(1) That sick-room infection is more common than is supposed, and that the danger of it does not receive the amount of attention it deserves. (2) That sick-room infection is much commoner in the small and often crowded houses of the poor than in the larger houses of the well-to-do. He also quotes Dr. Boobbyer's experience at Nottingham as to the greater frequency of enteric fever in houses of small accommodation. Boobbyer considers that the disease is communicable by personal intercourse even in well regulated hospitals, and more so in the confined dwellings of the poor ; and Parsons that harm is done by underrating its communicability. Seaton and Bulstrode share in the same views, and Blake supports it by a record of cases. Drs. Barrs, Pearson, and Willoughby maintain the usual view, that when a person contracts enteric fever directly from the sick, it is due to his own disregard of precautions of cleanliness ; but S. Cameron and Evans allow in addition a certain amount of aërial convection, much less of course than in the case of small-pox. From Italy it is reported that in a certain institution the passing of an imperfectly cleansed clinical thermometer from anus to anus was a means of spread. In investigating an outbreak of 13 cases in Germany, Kübler and Neufeld came to the conclusion that while the second case arose from pollution of the well by the dejecta of the first case, the remaining 11 cases were due to direct or sick-room infection.

Flies.—It has been found that the virus of enteric fever is not weakened by passing through the alimentary canal of flies. It is believed therefore that flies may convey infection not merely by carrying it adhering to the outside of their bodies, but also by ingesting it from fæces, urine, &c., and subsequently dejecting it on to articles of food or drink destined for consumption by man. The large part that flies were, as the result of investigation, thought to have taken in the spread of enteric fever in the American army camps at the time of the Cuban War, was mentioned in a former report. Nuttall agrees with Veeder that flies are not sufficiently thought of, while water is always blamed. V. Poore, on the other hand, says—

> We hear much about flies conveying fever, which may be true ; but we must always bear in mind what I feel inclined to call the excessive specialism of Nature.
>
> Insects which feed on dung and carrion are seldom attracted by the food of human beings, and I confess to being somewhat sceptical as to the accidental conveyance of infection by "flies" which heedlessly buzz first into the fæces and then into the milk.

Medical officers in India frequently refer to the danger from flies that come from the latrines and alight on food or drink in the cook-rooms or barracks.

Dust.—Kenwood speaks of the danger of the enteric bacillus getting into the dust of the room, and thus into food and drink ; Nollet describes the finding of the bacillus in the interstices of the woodwork of a barrack in France ; Sanglé-Ferrière and Remlinger assert that during an epidemic in Tunis they found the enteric bacillus, and in a second epidemic there the colon bacillus and an enteric-like bacillus, in the dust of the air, though not in the water, cases of fever having previously occurred among the inhabitants of the ground that was defiled with excrement ; and Newman in a description (characterized by *Nature* as a little difficult of comprehension) of an experiment of his own seems to indicate that in the perfectly still atmosphere of a bell-jar the enteric bacillus, once it had become dry enough, was able to ascend into the air, and contaminate sterilized milk, and also water, contained in small vessels under the bell-jar. On the other hand, Neisser, as has been noticed in former reports, considers the conveyance of enteric fever by room dust as impossible, because the degree of drying necessary before it can be carried about in dust is fatal to the bacillus. The mode of infection by the spray of coughing, proved for some diseases, can, as far as present knowledge allows judgment, have little bearing on the conveyance of enteric fever ; unless, perhaps, when pneumonia is present. (*See* under "The Bacillus in Sputum.")

Soil.—S. Martin, continuing his well-known investigations, found that in sterilized samples of earth from cultivated districts and preserved from drying, the enteric bacillus not only retained its vitality for 456 days, but spread through and over the whole soil. Even in dust-dry similar samples it lived for 49 days. The experiments were successful not only at incubation temperature but also at average outside temperatures. In sandy or turfy virgin soil the bacillus quickly perished. From inoculated unsterilized samples of such soils as are after sterilization good for growing it, the enteric bacillus could be recovered after 50 days, though, owing to the presence of the colon bacillus, the process was very long and difficult.

It has been said on the one hand that a water-logged soil rich in organic matter, on the other that a soil at a temperature over 60° F. and with moisture under saturation, ought to be favourable to the enteric bacillus ; but in India the disease seems

most prevalent in the drier parts of the country, and is very commonly at its maximum in the driest time of the year. As indicating a connection of enteric fever with the soil, it has been pointed out by Haffkine that the enteric virus may stick to the infected locality for years, and may, in spite of improvement in the water-supply, cause a continuous incidence of the disease, for which, occasionally, nothing short of complete evacuation of the locality is an effective remedy. It does not seem to be suggested that there is anything mysterious in the connection between enteric fever and soil, or that any deep geological problems are involved. The whole danger lies in the defilement; though that may perhaps be influenced in extent or duration by local geological formation, as contended by Sir Charles Cameron in the case of Dublin. At any rate, till more is really known on the subject, most sanitarians will be inclined to share in and act on the belief of Sir Charles Cameron that "the cleaner the soil we live on, the longer we are likely to live on it."

Water Filters and Allied Topics.—As Houston says, when the bacteriology of soil is better known, it will be possible to prophesy the bacteriology of a water, provided its origin is known. Many of the bacteria found in surface soils do not commonly occur as water organisms: hence the discovery of these particular organisms would indicate contamination with flood water. He found that the colon bacillus and the bacillus of Gaertner were more easily isolated from recently manured soil, and Klein agrees with him that "in the *bacillus enteritidis sporogenes* (Gaertner) we have a new test for contamination of soils, and therefore of waters derived from them." In investigating the recent outbreak at Belfast, Lorrain Smith found in the spleen of those who died the enteric bacillus and the colon bacillus, but in the water only colon bacilli and not the enteric bacillus. But because some of these colon bacilli occurring in the water were pathogenic to animals and reacted by the clumping test to enteric serum, he concluded that they were directly concerned in the infection. His general conclusions were—

1. In the presence in the water of typical bacilli of the coli communis group we find evidence of contamination with intestinal excreta. 2. Certain of these bacilli exhibit their relationship to the process of infection in typhoid fever: (*a*) by their lethal effect on small animals, (*b*) by showing the reaction of infection when exposed to the blood of typhoid patients. . . . Short of discovering in the water the typhoid bacillus also, and thereby giving absolute proof regarding the primary cause of the epidemic, I know of no stronger bacteriological evidence than that which I have adduced in favour of the conclusion that this contamination of the water is one of the causes of the outbreak of the disease in Belfast.

On the other hand a reviewer of Lorrain Smith's report, on the ground that the incidence of the disease was unequal in the city, and that the City Gaol and the asylum escaped, considers that the outbreak was more probably due to soil pollution. In criticising the report on the Maidstone epidemic Sims Woodhead stated that the presence of the *bacillus coli communis* should be regarded as evidence of contamination, provided that the bacillus found had certain biological characters and was pathogenic to animals. Kübler and Neufeld, investigating an outbreak in Germany, isolated from the well the enteric bacillus, and four weeks later a bacillus which, though not pathogenic to animals, agreed with genuine enteric bacilli in appearance, in motility, and in behaviour to the chemical tests, and was also agglutinated by enteric serum. It was apparently an enteric bacillus of diminished virulence. They point out that for the positive identification of enteric-like bacilli found in water, the serum test is absolutely indispensable. Their claim to be the first to have proved the presence of the enteric bacillus in water by a faultless method of diagnosis will probably be disputed by Hankin in India and by others in Europe. The success of the bacteriological examination a month or more after the supposed time of pollution of the water was supposed to point to original infection by large numbers of bacilli, and this, together with the absence of the colon bacillus, seemed to indicate pollution by urine (see under "Urine"). The well was supposed to have been infected by the washing near it of the sick-room utensils used by the first case; but after the occurrence of the second case it was put out of use, boiled water was issued, and the stools were treated with milk of lime. Nevertheless 11 more cases occurred, which were attributed to sick-room infection. During the time the well was out of use a stranger, ignorant of the circumstances, drank of it, and got enteric fever. As a rule, water is not examined till too late—after the incubation and outbreak, or even after the subsidence of the disease; at least, that is the reason usually given for failure to find the microbe. Constant examination, or a lucky investigation after a copious pollution, would seem the circumstances under which success is most likely. If the chances against the success of bacteriological examination be so great, still less can chemical examination, though it may indicate danger, ever tell with certainty that water is free from specific infection. Klein and Houston infected sterile distilled water with

sewage in varying degrees representing dilutions of sewage ranging between 1 in 100 and 1 in 20,000. Chemically they found that the majority of these waters would have been classed as at least organically safe drinking-water, but in each and all of them the *bacillus coli* and the *bacillus enteritidis sporogenes* were detected. The presence in water of the *bacillus pyogenes cloacinus*, isolated by Klein from sewage, would also be condemnatory. Blaxall, in noticing the rarity with which the enteric bacillus is found in suspected water, and offering the usual explanation, contends that such water rarely fails to show the presence of the colon bacillus and other bacteria that point to excremental pollution. An opinion to somewhat the same effect was quoted in the report for 1895, from McWeeney. Abel, on the other hand, remarks that as the *bacillus coli* is everywhere, its presence in water does not necessarily mean anything serious. The truth seems to be that, while the mere presence of the colon bacillus in water is insignificant, its constant presence or its presence in large numbers, especially in a form that is pathogenic to animals or re-acts with enteric serum, is a sign of danger past or present or possible.

Both the enteric bacillus and the colon bacillus are distinguished from the natural water-microbes by their inability to live in distilled water for long periods. The enteric bacillus, if shaken in sterilized water, soon perishes; and, according to Frankland, Ackermann explains this by supposing that the flagella are nutrient rootlets, and get broken off in the shaking, so that the bacillus can no longer absorb food. This however, is a mere speculation.

In contradiction of the results of other observers, Malfitano reports that no permanent biological modification in the bacteria employed was observed to result from exposure to compressed carbonic acid gas, though the pressure was raised to 55 atmospheres. Nor was he more successful when he exposed the bacteria to the interrupted action of the gas; and he concludes therefore that the purity of aërated water depends on the care taken by the manufacturers to sterilize the original fluid. The enteric bacillus is said to have been isolated from impure ice.

M. Treelle reports that in 1893 a violent epidemic broke out in Tiemcen. One of the barracks was supplied with water filtered through Pasteur filters, and yet only in that one did an epidemic of enteric fever break out. The other barracks were not provided with filters. In an epidemic at Castres in 1897, the barracks outside the city, provided with water filtered through Pasteur filters, were severely tried, whereas the scholastic establishments in the centre of the city entirely escaped. Again, Dr. Nollet says:—

> After a period of infatuation the Chamberland filter no longer commands the confidence of hygienists. The *bougie Chamberland* may be useful in a laboratory, but it is by far too fragile for a barrack-room. A filter with a fissure through it, or one badly looked after, is worse than none at all. If, however, it should be decided to retain the Chamberland *bougie* in spite of its many defects, then each one in use should be tested daily by the regimental medical officer.

On the other hand, Defries endeavours to prove by statistics that the Pasteur-Chamberland filter has really been of use in the French army. The Berkefeld filter, Lunt states, after a few days' use, lets through water-bacteria, but not the colon bacillus, the enteric bacillus, or the cholera vibrio, at least not for some weeks. So, too, van't Hoff found that with sand-filtration too slow passage of the water was as bad as too quick, probably because the delay allows the bacteria to multiply in the stagnated water and in the filter. Delépine is quoted as showing that it is very difficult to purify by sand-filtration water that has once been polluted; filtration does not give absolute security, and when the water is unpolluted it is unnecessary. Instead of filtering the water after it has been polluted, it is better to protect it from pollution at the source.

It has been said that "water polluted with sewage at its source produces enteric fever at its distribution," some understanding this to mean sewage as sewage, others considering it to be true only of sewage containing the enteric bacillus; but, while that is the history of explosive outbreaks, it seems to be equally a fact that "endemic and annually recurrent prevalence of enteric fever depends on local and permanent insanitary conditions." As Haffkine says, while cholera infection seems to be almost exclusively confined to the water-supply, in the case of enteric fever, improvement of the water seems to leave intact a large number of other sources of danger, which have as yet escaped recognition. In fact, it is coming to be more and more clearly perceived that enteric fever is not simply and solely a water-borne disease. However, on the other hand, S. Cameron suggests (and this seems to have been the belief also of the late E. Hart) that polluted water containing bacilli in too small numbers to produce an explosive outbreak may yet cause cases, attacking those who drink much of it, or those who are very susceptible.

Various experiments have been made by the use of the *bacillus prodigiosus*, aniline dyes, kerosene oil, or easily recognizable chemical substances, as to the filtering power of the ground, and as to the possibility of the contamination of well water by the way of surrounding soil. The result of such experiments seems to be on the whole that the danger is greater than had been suspected. The actual or possible existence of faults, sun-cracks, rat-holes, or worm-burrows has to be reckoned with.

With reference to a remark made on page 28 of the report for 1897, Mr. Hankin has pointed out that, while Abba's experiments were made with Pasteur-Chamberland bougies, his own were done with the ordinary coarse country earthenware. A note by Mr. Hankin on the detection of the enteric bacillus in water, etc., is printed as an appendix to this section (not reprinted).

Milk and Butter.—Bolley and Field found that, after the enteric bacillus had been introduced into butter, 10 days was the longest time it could be detected. When, however, the cream was infected with enteric germs before churning, they could be discovered in the butter even after three months. They report that the enteric bacillus does not grow in butter if the buttermilk has been thoroughly worked out of it, but that if it is left, they increase ; that in sterilized milk the bacillus can exist for upwards of four months ; that innoculated into freshly-drawn milk, the bacillus can be demonstrated as long as three months afterwards ; that no types of bacteria were met with in milk which proved capable of overcoming the enteric bacillus ; that the same bacillus, when inoculated even in comparatively small quantities into sour milk, took wellnigh complete possession of the liquid, becoming almost a pure culture. As in the case of water, it is not usual to succeed in finding the bacillus in suspected milk, even when the chain of evidence seems otherwise complete, and when the disease appears to be stopped by measures directed to the milk-supply. An outbreak affecting 42 out of 45 inmates of a pauper asylum was traced by Naegeli to the man who milked the cows, and who, though he had never knocked off work, was shown by Widal's test to have been an example of ambulant enteric fever. A similar chain of events was observed in Glasgow.

Sewer-gas, Foul Air, Insanitation, Geology.—The enteric bacillus has never been discovered, and according to present knowledge is not likely to be discovered, in sewer air. But cases still continue to be reported in which medical men are convinced of the casual relation of sewer gas to the fever. Thus, Wyatt Smith, stimulated by the publication by Nash of several series of cases of different diseases supposed to have been produced by sewer air, places on record an instance in which three cases seem to have so originated. The record is not quite convincing, owing to the absence of stringent proof that the disease could not have been contracted otherwise than by inhalation. There seems to be spreading abroad a revived opinion that sewer air inhaled, or sewage-polluted water drunk, even if the enteric bacillus be absent from them, can produce or induce enteric fever. But, so far as is known, there is no enteric fever without the Eberth's bacillus. In such cases the bacillus must, therefore, come in somewhere. The explanation, accordingly, may be that the bacillus, perhaps in an attenuated condition, is already present in the bodies of the patients ; and that the chemical products of putrefaction, inhaled in the sewer air, or ingested in the sewage-polluted water, depressed the human organism, or exhalted the microbe, or both ; thus giving an advantage to the microbe, and enabling it to overcome the somatic resistance. Towards the action of filth products, however, it seems that the human organism is capable of acquiring tolerance ; and thereby it becomes less liable to enteric fever. It is possible, therefore, that modern sanitation, while diminishing the chances of exposure to the bacillus and to the filth products that favour its action, increases the susceptibility of man. Thus, the English soldier is tolerably safe in England, without the aid of filth-tolerance ; but when he is transferred to a land of insanitation like India, his want of filth-tolerance tells against him. It may even be feared that the comparative purity of cantonments in India, like the comparative purity of the land he has come from, may make the British soldier more prone to infection in the dirty bazaars. It has been said that enteric fever is the disease which shows most the influence of sanitary improvements ; and no doubt it may be so when the improvement is widespread over the country ; but in India the Europeans who live in clean cantonments and civil lines cannot, or do not, keep themselves quite unspotted from the primitive filth of the great mass of the country. This surrounding filth is ever ready to encroach on any cantonment where there is the slightest laxity of sanitary supervision, and is a standing danger to individuals. Since efforts to banish enteric fever by purifying the water-supply have met with so much less success than was expected, medical officers, aided by the visits of special sanitary officers, have been forced

to turn their attention to the details of the sanitary condition of their stations. Some sanitary transgressions and omissions are found in the lines, but more in the bazaars ; and it may here be noticed that in France the measure which in India is called "putting the bazaar out of bounds" is said to have met with some success in checking the disease.

Boobbyer of Nottingham's experience is that the disease is endemic in poor overcrowded localities, irrespective of geological formation, provided that soil-pollution and like favourable conditions are present, and that, under equally unfavourable circumstances, the better class of houses has fewer cases than the poorer. This latter point is explained by some as the result of sick-room infection in small overcrowded houses. Sir Charles Cameron's observations on the greater incidence in Dublin of enteric fever on the gravel soil than on the clay, and the supposed explanation, are noticed in the Army Medical Report for 1897. His views have been disputed.

Auto-Infection.—In the narration of their investigations into the Belfast epidemic, Lorrain Smith and Tennant have occasion to refer to the experimental results obtained by Sanarelli, some account of which will be found in the report for 1894, paragraphs 14 and 52, pages 25 and 69. The two results of Sanarelli's work, they say, which have a direct bearing on their own investigations are (1) the effect of coli products in increasing the virulence of the typhoid bacillus, and (2) the effect of the injection of typhoid toxin in bringing about an invasion by the colon bacillus ; Sanarelli thinking it probable that auto-intoxication with products of intestinal fermentation is a factor in the causation of typhoid fever—a suggestion which brings the theory of the disease into line with his experimental results. Their object in the investigation was to show that in patients there can be obtained from the serum indications of colon bacillus invasion during the process of typhoid fever ; and there is a large body of evidence to prove that Sanarelli's experimental results are directly applicable to typhoid disease in the human subject. The supposed danger seems to be that a poisoning from the intestine or a change in the condition of the intestinal flora may make a man fall an easier victim to the enteric bacillus, if the latter enters at the proper moment. Another view is that the *bacillus coli* under certain unknown conditions becomes changed into the enteric bacillus. A third is that enteric fever is not a unity, but a congeries of symptoms which may be caused now by the enteric bacillus, now by the *bacillus coli*, now by the bacillus of Gaertner, etc. D. B. Spencer wishes to distinguish between true enteric fever, due to the ingestion of sewage matter from outside the body, and fermentation fever, of which "tropical enteric fever" is a form due to sewage matter belonging to the body.

Origin-tracing.—It is not only in India that difficulty is found in tracing the actual channel of infection in a given outbreak. Both Peck of Chesterfield and Mair of Gainsborough learned by experience that, while it is frequently easy to find a number of possible causes, it is hardly ever easy to fix upon one undoubted cause, and sometimes impossible even to guess one ; and Mair was able to trace origin from a previous case only in 31 per cent. of attacks.

Weather and Season.—Berger, for a locality in Germany, found that enteric fever was most prevalent in August and least so in November-February ; that it was at its height when temperature, humidity, and dew-point rose ; taking only pressure and temperature, that it rose when pressure fell and temperature rose ; taking pressure, temperature and humidity, that it was at its highest when pressure, temperature, and humidity rose, and at its lowest when pressure rose with temperature and humidity falling, or when humidity rose with barometer and temperature falling. Similar detailed observations are wanting for India. In England it is said that a high (over 55° F.) sustained summer temperature is followed by a high autumnal prevalence, and a cool summer by a low autumnal prevalence, and that enteric fever and diarrhœa are therefore parallel in their relations to temperature.

Hardiness.—It has already been mentioned that the enteric bacillus has been recovered from unsterilized soil 50 days after inoculation into it. Klein found that in the period between 15 and 20 days the enteric bacillus had died out in buried bodies of guinea-pigs ; Pfuhl, that the enteric bacillus can flourish on boiled potato and grow into its substance even in the presence of the colon bacillus or the bacilli of garden earth ; Sitsen, that drying produces first increased resistance against carbolic acid, and ultimately diminished resistance. A very general statement of Ficker's results is that thin layers of old, not very virulent, cultures are more easily killed by drying than cultures of opposite characters, and the higher the temperature the more easily ; that alterations of dryness and moisture are very fatal ; and that moist heat kills more quickly young cultures than old. It has already been mentioned that the enteric bacillus can be killed in water by shaking.

Friends and Enemies. Mixed Infection.—Both Lorrain Smith and Houston agree with Sanarelli that symbiosis with the enteric bacillus increases the virulence of the colon bacillus, and that, on the other hand, the *bacillus coli* may be directly concerned in the production of a virulent enteric infection. In his experiments Sanarelli had found that the bacillus of Escherich produces increase of virulence of the bacillus of Eberth, and that the injection of enteric toxin favours invasion by the *bacillus coli*. It is said also that the staphylococcus is inimical to the enteric bacillus, while the streptococcus is helpful to it. Attempts have been made by means of the Gruber-Widal reaction to diagnose mixed infections, and it has been suggested that not only the colon bacillus but also the bacillus of Gaertner, and perhaps other bacilli, may occur in mixed infection with the enteric. Thus, Biberstein found that in 15 out of 18 cases enteric patients' serum agglutinated the colon bacillus more than the normal serum did, and sometimes agglutinated the colon bacillus more than the enteric ; the inference being that in these cases the patient was invaded both by the bacillus of Eberth and by that of Escherich. Evidence of the existence of mixed infection by the same two bacilli was obtained in Belfast, as already noted, by Lorrain Smith.

Susceptibility.—It is supposed that "enteric families" exist, families that are more liable than others to be attacked by enteric fever, either from a general susceptibility of body or from an idiosyncratic constitution of the intestinal flora. So, too, there is some evidence of the existence of "enteric houses," houses which have been repeatedly invaded in different years ; but it is to be presumed that it is only change of tenants which directs attention to such houses, because, as a rule, constant dwellers in insanitary surroundings seem to acquire a certain amount of tolerance of the enteric virus, though new comers are very apt to suffer. Whitelegge has noticed that such acclimatized persons are apt to get enteric fever after they have been away on a visit to the sea-side, having lost their immunity by the change of residence. But in the short report of his remarks the proof is not given that the infection was not contracted at the sea-side. The opinion of the medical officer of Ahmednagar, quoted in paragraph 16, page 29, of the report for 1897, may be referred to. It is probable that the enteric bacillus, like other pathogenic microbes, can only attack the enfeebled ; but it is not quite clear whether general enfeeblement is enough, or whether a particular kind of enfeeblement is necessary. Children also are liable to the disease, but the younger the child the less the march of the attack is like that seen in the adult. The evidence regarding a possible greater liability of total abstainers is very imperfect ; but even if the greater liability were proved, it would be an argument not against total abstention but for the purification of water-supplies. The question is chiefly interesting in that some look to a greater liability of abstainers as a proof of water-conveyance.

Cycles and change of Type.—If there is any truth in the idea mooted in England that the lessened prevalence and mortality from enteric fever, said to be attended by some change of type in symptoms and lesions, is at least partly due, not to sanitary improvement, but to a cyclical diminution of infectivity, India may be in a cycle of increase.

Enteric-like Fevers. Typho-malarial Fevers. Diagnosis.—It is well known that there are some who hold that the so-called enteric fever met with in India, or at least the bulk of it, is not the same as the enteric fever of Europe, and D. B. Spencer has lately asserted that true enteric fever is rare in India. The great body of opinion, and the results of bacteriological investigation, so far as they have gone, are, however, in favour of the view that the enteric fever of India is the same as that of Europe, though there may in India, as in Europe, occur cases of enteric-like fever caused by other and related bacilli. The colon bacillus, which has a bad record as a cause or accomplice in many diseased conditions, is most frequently blamed for these enteric-like fevers, though the *bacillus enteritidis sporogenes* (Gaertner) has also been accused in such cases. Gwyn in a case which was clinically typical found a paracolon bacillus which had characters of both the enteric bacillus and the colon bacillus. It is possible that in such cases the bacillus met with was the *bacillus faecalis alkaligenes*, which is said to be nearer the enteric bacillus than the colon bacillus is. The evidence available goes to show that there is no separate fever to be called "typho-malarial," cases so designated being mixed infections by the malarial animalcule and the enteric bacillus. At least 31 cases have been published (29 by Lyon, 1 by Wilson, 1 by Goltman) in which both parasites were found to be present by bacteriological and microscopical methods. Cases have been published of sudden influenza passing ultimately into enteric fever immediately after an epidemic of influenza, and of confusion of diagnosis between the two at the beginning of an outbreak (Clifton). Difficulty of diagnosis also arises with tubercle, simple continued fever, plague, etc.

Enteric Fever a Blood Disease. The Bacillus in the Blood. The Bacillus in Sputum and Sweat.—In reporting a case of cystitis caused by the enteric bacillus, which remained localised in the bladder though it communicated to the blood the power of agglutination, Houston concludes that the fact that the enteric bacillus can grow in the tissues without any symptoms of enteric fever resulting, and produce there a local lesion, is in favour of the view that this fever is a true general infection, and not merely of local origin in the Peyer's patches of the intestine. Experiment seems to show that the intestinal bacteria cannot get through the healthy intestinal wall. Sudakoff found the enteric bacillus in the blood in one case, in the blood and sweat in one case, and in the sweat in one case. The blood from the roseola from 14 cases was examined by Neufeld by a new method, of which rapid work, so as to avoid the bactericidal action of the blood, and the use of a fluid medium, were the chief features; and from only one did he fail to cultivate the bacillus, and that case was also refractory to the Widal and other bacteriological tests. Richardson found the bacillus in the sputum of a case with pneumonia on three successive days; but he failed to find it in 15 cases where there was no pneumonia.

Enteric Fever without intestinal lesions.—Cases of enteric fever without intestinal lesions continue to be reported; but a certain amount of doubt rests upon many of them on account of the insufficient proof offered that the bacillus found in the organs was really the enteric bacillus. However, some cases have been properly authenticated. It has been suggested that enteric fever without lesions is more frequent now than formerly, on account of a change of type in the disease, the brunt of which tends to fall on other systems or parts of the body rather than on the intestinal. If this be the case, enteric fever must, as Sanarelli contends, be a blood disease with a secondary intestinal infection, and not an intestinal disease with a secondary blood-infection. It was mentioned in last report that some of these cases are supposed to be caused by the bacillus of Gaertner.

The Bacillus in the Organs, and its presence for long periods.—The enteric bacillus can often be found in the gall-bladder when it is no longer present in the stools, and it may there be in pure culture. The gall-bladder may itself be affected with inflammation, ulceration, or perforation, and the presence therein of attenuated enteric or colon baccilli sometimes leads to the formation of gall-stones. It is stated that the enteric baccillus has been found in pure culture in suppurative lesions in the ribs, clavicle, radius, ulna, femur, tibia, and the bones of the fingers and toes; in the blood, the heart muscle, the endocardium, the arteries and veins of the legs; in the muscles of the neck, shoulder, abdominal wall, and legs; in the peritoneal cavity, the spleen, the liver, the bile, the kidney, the urine, and the mesenteric glands; in the brain, the parotid gland, the thyroid gland; in the lungs and the pleura; in the ovary; in the testicle. The cases of mixed infection are equally numerous and widespread. It has sometimes been found in the bone-marrow, even in cases that gave no Widal reaction, also in cases of abscess of the connective tissue, periostitis, osteomyelitis, empyema, pleurisy, in typhoid lesions of the larynx, in otitis media, in diseases of the testicle and thyroid gland; in ulcers of the vulva and vagina, and in abscesses of the glands of Bartholin. Cases in which the enteric bacillus has been found in pure culture in the body up to 8 or even 15 years are quoted from von Dungern, Buschke, Bruni, Sultan, Chantemesse, Houston, and others. References on this subject were also given in the report for 1897.

Experiments on Animals.—Chantemesse reports having given a monkey enteric fever by feeding it with small quantities of bacilli for three or four days. It died on the twelfth day, and there were found ulcers in the large intestine and caecum and swelling of the mesenteric glands and spleen. In sections of the spleen there were numerous enteric bacilli. Row successfully exalted the virulence of cultures by passage, the animals used being guinea-pigs.

Prevention. Inoculation.—To kill or intercept the microbe and to increase the resisting power of men are the two methods of prevention; and general measures of sanitation are believed to act in both ways, because the purer the surroundings the more healthy the human individual will be, and the less likely to meet with noxious germs. But there is some suspicion, as has already been mentioned, that purity of surroundings may actually make men more susceptible to corporeal depression by a subsequently experienced impurity of environment, and therefore more apt to fall victims to the virus of enteric fever. Sanitary purity would be more effectual if it were general, but in India at present it can only be partial. It is known that the soldier in his clean lines and barracks is closely surrounded by the pollutions of the bazaar, and the enteric bacillus is widely

distributed. Therefore recourse to the inoculation methods of Wright is by many strongly advocated.* Haffkine thus concludes a lecture of argument delivered before the Royal Society :—

From the point of view of preventive measures, in diseases like rabies, or syphilis, or small-pox, or leprosy, where infection can be found in the patient alone, precautions of isolation taken with regard to the sick and their closest surroundings must affect directly the prevalence and propagation of the disease ; whereas in typhoid fever, or cholera, or plague, where the patient is only one, and proportionately a limited source of danger, his isolation, and the destruction of his belongings, leave unaffected the vast cultivations of infection which are going on in nature besides ; and measures taken for circumscribing the prevalence of the epidemic by isolating and destroying the foci of infection are less likely to succeed in this category of diseases. Attempts to eradicate an epidemic or to protect individuals by means which succeed in merely contagious diseases will in this case easily be eluded, and the necessity of personal protection by means of prophylactic treatment will be soon urgently felt and acknowledged.

Opinions of Medical Officers.—In but few cases is it stated that particular regiments or barracks were especially attacked. As usual, the most salient factor in such cases was recent arrival in India of the regiment, or of drafts, coupled with youthfulness of the men, greater nearness to bazaars, or greater exposure to infection-laden wind being among the contributory causes adduced. In some cases no explanation is attempted. At least two men, and perhaps three, appear to have already contracted the infection before they landed in India, while two or three are said to have been infected at Bombay, or *en route* therefrom. Medical officers frequently noted, especially in the case of hill stations, that the disease must have been contracted before arrival, either from impurities encountered on the march, or from a cause existing in the previous station ; so that the station where the disease was treated was not always the station in which it was contracted. Into Shahjahanpur two cases were imported, it is said, and the disease then quickly spread. The danger of ambulant cases is also noticed in some reports. The evil effect upon individuals or upon regiments of active service on or beyond the North-West Frontier was observed in several stations. One medical officer expresses the opinion that the so-called enteric fever of India is climatic in origin, and that ague is a principal factor in its causation ; while another considers that ague acts indirectly by deranging the safeguarding function of the liver. Typical *post-mortem* appearances were noted at Cherat and Bangalore, and the medical officer of the former station believes that the enteric fever of India is not the same as that of England. A belief is expressed by the medical officer of Nasirabad that enteric fever in India may be caused by microbes other than that of Eberth, by the *bacillus coli* for example. Some patients acknowledged having drunk foul or doubtful water in the bazaar, or when out shooting, or on the march, or on the rifle-range, or when rambling about the khuds. The bazaar is, as usual, considered by many medical officers as the place where enteric fever is mostly contracted, by the partaking of aërated waters, ice-cream, fruit, cakes ; suppers in shops, eatinghouses, or brothels. The medical officer of Nasirabad mentions that urine and even fæces have been found in the so-called drinking water standing ready in a brothel. At Poona seven of the attacks were among men who were constantly about the bazaars on plague duty. In the experience of Umballa and Poona, placing the bazaar out of bounds had a good effect. At Calcutta a milkman was detected washing his cans with dirty water ; at Jutogh a bhisti was seen filling his mussack from a dirty pond, and it was discovered that the galvanised iron tanks were being cleaned with the aid of mud ; and at Peshawar it was found that the water-pipes in their course sometimes passed through foul irrigation channels. With regard to Shahjahanpur it is stated that mussacks were used, that the wells were not protected with permanganate of potassium, that the latrine arrangements were bad, that there were no chicks to the kitchens, and that when these defects were remedied the epidemic ceased. It is said that after the wells at Roorkee were put in good order and the water-barrels cleaned, there were no more cases of enteric fever. At some other stations mussacks, pakhals, and motes were still in use, with unprotected wells. At Jullundur the distribution of the drinking water, and at Aden the distribution and storage of the same, and the disposal of the waste water, were reported to be faulty ; and liability to contamination is asserted with regard to the water-supply of Umballa, Bellary, Meiktila, Mandalay, Poona, Nasirabad, and Deolali. At Poona variation of water-head pressure was supposed to induce suction of external, and perhaps foul, moisture into faultily joined or damaged pipes. A multiple water-supply, always a dangerous arrangement, was reported as existing at Calcutta, Ranikhet,

* A certain amount of inoculation work has actually been carried out, but no reports on the subject have yet been received.

Fort Lahore, Fort Attock, Thobba, Murree, Madras, Secunderabad, Rangoon, Shwebo, Purandhar, Nasirabad, Neemuch, Taragarh, and Aden. The municipal water was suspected in the case of Cawnpore and Agra, though the civil population did not suffer to the same extent as the military. At Agra the enteric bacillus was reported present in the water of No. 4 well, and on three occasions in the municipal water ; and at Mhow a bacillus resembling that of Eberth was found in the lake-water. The enteric bacillus having been found in the water of a camp well at Meerut, the regiment moved away, with good effect. At Bangalore the medical officer noticed that most cases were occurring in bungalows on low ground and near the horse-lines, but this incidence was, in his opinion, afterwards explained by the finding of the enteric bacillus in some drinking water placed near the horse-lines for the use of the men. The result of bacteriological examination in the case of Jubbulpore, Sitapur, Fatehgarh, Ranikhet, Bellary, Nasirabad, and Mount Abu was negative. At some stations the water was regarded as excluded from the possible vehicles of infection, because the outbreak was not widespread ; while the medical officer of Chakrata points out that enteric fever was less prevalent there at a time when the *bacillus typhi abdominalis* was reported present in the water than it is now when the water is reported pure. At Quetta the water-supply was insufficient. The arrangements for the manufacture and supply of aërated waters was here and there unsatisfactory, but no cases of enteric fever were traced to this condition of things. The combined results of five stations was that 116 cases occurred among total abstainers, and 396 in non-abstainers, or 23 and 77 per cent. respectively. But, as their average annual strength cannot be obtained, no conclusion can be drawn as to the relative liability of those two classes. That there was no observable difference of liability was the belief of the medical officers of Rawalpindi and Bangalore. At Kasauli and Poona the medical officers were not satisfied with the dairy arrangements. In certain stations the immunity, or comparative immunity, of women and children was used, as in previous years, as an argument against the probability of the spread of the disease by means of milk, whereas in others the fact that women and children suffered was held to throw suspicion upon the milk or upon something affecting women and children as well as men, such as air-borne fæcal dust. The fact that attention to dairies and milk-supply had produced no effect on the annual amount of enteric fever was also advanced as a proof that milk had not been a vehicle. There was an impression at Jubbulpore that the subsoil water had risen of late years owing to the new water-supply and the disuse of the wells ; and the medical officer of Ranikhet says that there has been more enteric fever at Lucknow since wells were disused and the Gumti water taken into use, the circulation of the ground water having been choked. At Jhansi, on the other hand, the prevalence of enteric fever was attributed to the very low level of the subsoil water and the considerable drying up of the wells, the result of a three years' drought. Unlike Jubbulpore and Lucknow, however, Jhansi had a lower enteric fever admission ratio in 1898 than in 1897. The question of the conveyance of the infection in dust-laden wind has again attained some prominence in 1898. The infective dust is supposed to enter into the mouths of the men, to fall into the water, and to settle upon the food. Along with dust, flies are mentioned as likely carriers of infection from fæces to food. Some medical officers, therefore, dwell on the importance of protecting the kitchens from dust and flies, of excluding from them all natives except the actual cooks, and of closely supervising the cleanliness and personal habits of the cooks, who are often sweepers, or little better. For some regiments stringent detailed rules as to the management of the cookhouses were issued under the authority of the officer commanding. One reform suggested from various sides is that the men should be made to cook for themselves without the aid of natives, and this has actually been carried out by the Gordon Highlanders. The conveyance of infection by means of air-borne dust, if a reality, must be confined to the dry seasons, and dust-storms are most frequent in the dry hot season ; but a second maximum of the disease in the damp months of August and September is very usual ; and the medical officer at Rangoon remarks that cases generally begin to come in after the first rain. Exposure to the sun and fatigue from work at the rifle range, from military training, from football training, or from other exertion are mentioned in some reports as contributory causes. The danger in badly managed mortuaries from the careless spreading abroad of undisinfected intestinal contents, a danger brought to notice by V. Poore, is again this year referred to. The medical officer at Cherat stated that some of the bungalow sites and tent-sites were unhealthy, the lower on the hill the more unhealthy ; that there was a want of personal cleanliness, that there was a difficulty in ventilating tents, and that no cases could be traced to dirty native cooks or dirty tanks. Bernardmyo, which was first occupied in 1888, is said never to have *originated* a case of enteric fever. Fatehgarh had none during the year. The disease is said to be rare at

Calcutta, Pachmarhi, Roorkee, Mandalay, and Colaba. As to Roorkee, the reason given is that it is a small, clean station, to which young drafts do not come. The immunity of Mandalay is said to be in spite of a water supply very liable to contamination. The Dagshai Military Prison was always free from enteric fever, even before resort was had to boiling and permanganating the water; in 1896 the water contained the enteric bacillus, but no men got the disease; and in 1897 the medical officer's family partook of lemonade containing the bacillus, but all escaped. Meiktila is said to have had no enteric fever since 1895, the water having been boiled since April, 1896; and it is stated that Neemuch has had no cases that could be attributed to the station since the new water supply was introduced. The reduction in Kurrachee was supposed to be due to attention to all points of sanitation. At Meerut removal from the neighbourhood of a well containing the enteric bacillus was apparently successful in staying an outbreak; and good results were reported to have been obtained at Umballa and Poona by placing the bazaars out of bounds. On account of the persistent occurrence of enteric fever there, Dagshai was totally evacuated early in 1898, and remained unoccupied until April, 1899. A great deal of attention seems to have been devoted to the purification of the drinking water, a good deal to that of the aërated waters, and some to that of the milk. In some stations the wells were cleaned out once or twice a year, and were treated once a week with potassium permanganate. Boiling and the addition of potassium permanganate were very extensively used for the purification of the drinking water, the boiling being carried out in at least seven stations in Larymore patent boilers. In half a dozen stations alum was used. The men at Calicut are said to have drunk only aërated waters, because they did not like the permanganated water. A good deal appears to have been done in the matter of substituting galvanized iron vessels for leather ones. At Agra the water of a well in which the enteric microbe had been detected was treated with hydrochloric acid and potassium permanganate, and was examined bacteriologically once a week. The officer commanding at Sitapur issued detailed instructions regarding the care and purification of the wells and drinking water. At some of the stations in the Murree Hills the water was so pure that sterilization was not required, and that process was only resorted to when drought necessitated recourse to a second source of supply. Some regiments introduced filtration, permanganation, or boiling, as purificatory processes, into their aërated water factories, and used only permanganated water for washing the bottles. At Amritsar there are said to be no aërated waters sold in the bazaar except those of barrack manufacture. Precautions as to milk are usually mentioned, if at all, in general terms. The special measures noticed are milking in presence of a European, sending the milk out in locked cans, and boiling. At some stations incineration was resorted to for the destruction of infectious stools only, while in others an attempt was made to dispose of all nightsoil and rubbish by that method. The efficiency of the different incinerators employed was variously estimated. Reviewing the reports received on this point, His Excellency the Commander-in-Chief in India states that no thoroughly satisfactory incinerator has yet come under notice; that the incineration method must still be considered as being in the experimental stage; that experiments will be continued; and that a trial is being given at Cawnpore to an apparatus intended by its designer to consume both liquids and solids. The clothing worn by men suffering from enteric fever, venereal disease, and other infectious maladies, was boiled before being handed over to the washermen. Out of the 2,498 cases of enteric fever which occurred throughout the army of India in 1898, 37 are noticed as having declared themselves among patients in hospital or among attendants. Out of these about 11 were in hospital for early venereal disease, and about 8 for other diseases; and 18 were attendants on enteric fever cases. The number of attendants attacked was, as in the previous year, high. A second attack was the lot of a man at St. Thomas' Mount, whose first attack had been at Secunderabad in the previous year. Cases in which enteric fever and dysentery were more or less closely connected were observed at Calcutta, Barrackpore, and Quetta; but at Quetta this connexion was not so frequent as in the preceding year. A case each of enteric fever at Fyzabad, Cawnpore, and Umballa was complicated with multiple abscess of the liver, that lesion in the Fyzabad case being part of a general pyæmia; while in three cases of abscess of the liver, which occurred respectively at Lucknow, Agra, and Shwebo, the origin of the abscesses was stated to have been the intestinal ulceration of enteric fever. In a case of single abscess of the liver occurring at Lundi Kotal, the length of time that had elapsed since the close of the attack of enteric fever rendered the reality of the connexion somewhat doubtful.

Medical officers reported on outbreaks the causation of which was believed to have been discovered, or in the case of which the drinking water was suspected, or was said to contain the enteric bacillus; of the measures considered to have been effectual in preventing

or checking the disease; and especially of the results obtained by boiling the drinking water, or by adding to it potassium permanganate or other chemicals. Though 1898 was the third year in which those methods of water purification were officially in force, it will be seen from the following table that the amount of enteric fever in India still continued to increase. It is scarcely to be believed that the measures in question were everywhere so carelessly carried out as to be worse than useless, and the suspicion arises that in applying them to the water supply the authorities were not applying them to the real origin of the disease. This point was more fully dwelt upon in the report for 1897.

Commands.	Year.	Enteric Fever.		
		Admissions.	Ratio per 1,000 of strength.	Difference.
Bengal	1897	786	39·1	+ 2·0
	1898	824	41·1	
Punjab	1897	724	42·1	+ 6·6
	1898	895	48·7	
Madras	1897	237	19·2	− 7·6
	1898	143	11·6	
Bombay	1897	303	20·4	+ 14·7
	1898	513	35·1	
India	1897	2,214	32·4	+ 4·5
	1898	2,498	36·9	

No explanation can be offered as to the reduction in Madras and the rise in Bombay. The chief reductions in the Madras Command were at Rangoon, Secunderabad, Calicut, Mallapuram, and Pallavaram, though eight other stations had also lowered ratios. The chief rises in the Bombay Command were at Quetta, Kirkee, and Taragarh, though six other stations shared in the rise. Of the seven stations which *reported* the use of Larymore boilers for the sterilization of drinking water, Dinapore, Nasirabad, Neemuch, Indore and Mhow had admission ratios lower than those of their geographical groups, and Dinapore, Meerut, Indore, and Neemuch, admission ratios lower than those of their commands; while Meerut and Muttra had ratios higher than those of their geographical groups, and Muttra, Nasirabad, and Mhow, ratios higher than those of their commands.

Enteric Fever in 1898.—There was again an increase of both morbidity and mortality from enteric fever in 1898. The admission ratio rose from 32·4 to 36·9, and the death ratio from 9·01 to 10·17, a difference of 4·5 and 1·16, respectively. There were 2,498 admissions and 689 deaths, against 2,214 and 616 in 1897. The average number of men constantly sick* from enteric fever was 321, and the average duration of a case* was 56 days. The total loss of service* due to the disease was about 117,023 days. At Rawalpindi, Bangalore, Ahmednagar, and Quetta, Widal's test was employed as a means of diagnosis, 82 times at Quetta.

Fever Mortality.—The following table shows an increase in total fever mortality, which may with some reason be ascribed to the greater youthfulness and less average length of service of the soldiers of to-day :—

	1870–79.			1881–90.†			1897.			1898.		
	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.	Enteric fever.	Other fevers.*	Total of both.
Army of India	2·03	1·42	3·45	3·79	·70	4·49	9·01	1·02	10·03	10·17	·73	10·90

* Intermittent, remittent, and simple continued fevers.
† Excluding troops on active service in Burma during 1885 to 1887.

It is a well-known fact, and it may be seen in various tables of this report, that malarial is much less fatal than enteric fever. The liability to die of malarial fever is

* Excluding field forces, Malakand Force, and Kyber Force and Brigade.

greatest after 30 years of age, while the liability to die of enteric fever is greatest before 25. The British Army in India is at present a youthful army, with 90 per cent. of the men under 30 years of age, whereas the corresponding percentage in 1871—79 was only 67.* Similar results are arrived at with regard to length of residence in India. Therefore, the explanation offered above of the facts displayed in the table just given appears to be correct.

The following table shows enteric fever in the geographical groups in the decennium 1886—95 and in the last two years :—

Admissions per 1,000.

Period.	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.
1886–95 ...	5·7	5·5	7·7	27·7	25·4	15·6	23·9	17·0	5·8	12·1	25·1	13·9
1897	20·8	1·1	11·0	36·9	33·5	22·3	63·7	24·3	10·2	26·8	49·7	14·9
1898	7·3	4·5	19·3	44·1	36·6	29·6	47·1	25·7	2·6	19·3	59·7	20·3

It shows that Groups V, VI, VIII, and XII*a*, especially, are apt to have high ratios of admission from enteric fever; and Groups II and X, and, to a less extent, I and IV, low ratios. It also shows at a glance how the groups compare with each other in 1898, and how 1898 compares with 1897, or with the decennium. Group XII*a*, Hill Stations, had the highest ratio of 1898, and Group VIII, followed by Group V, the next highest; and in the same three groups also, but in the order XII*a*, V, VIII, the percentage of enteric fever in total admissions was greatest. The table also shows that, whereas in ten groups the ratios of both 1897 and 1898 were higher than the corresponding ratios of the decennium, only in Burma Inland were the ratios of both years lower than the decennial ratios. Moreover, in seven groups the 1898 ratios were greater than the corresponding ratios of both the preceding year and the decennium; while only in Western Coast was the 1898 ratio less than both.

As regards enteric fever in stations, the following table shows those garrisons which had an average strength of over 1,000 in 1898, with the decennial ratios for reference :—

Stations.	1898.		Decennium, 1886–95.	
	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
Quetta	108·5	35·08	15·0	3·15
Lucknow	74·1	22·57	37·3	7·07
Agra	73·5	16·71	24·0	7·66
Peshawar	52·0	24·48	18·7	7·88
Rawalpindi	51·8	10·95	24·5	6·85
Mhow	45·6	12·01	27·5	6·78
Allahabad†	43·6	16·03	24·2	4·84
Meerut	40·0	9·74	26·8	7·83
Umballa	35·3	13·19	21·7	5·41
Bangalore	30·3	4·26	16·0	3·47
Poona	24·2	4·73	15·4	5·06
Bareilly	20·9	5·44	39·8	9·41
Sialkot	17·7	8·45	38·8	8·89
Secunderabad ...	17·4	4·70	23·7	6·04
Fort William (Calcutta)	13·3	·89	4·3	2·13
Wellington	12·4	2·85	7·5	2·46
Aden	10·8	4·93	3·5	1·81
Rangoon	8·3	·92	5·4	2·55
Kurrachee	6·8	3·89	13·8	3·07
Colaba (Bombay) ...	2·5	·83	4·9	1·83
Belgam	1·9	97	2·2	·49

* Bryden and Stephen, Tables for 1870—79.

† Including Fort Allahabad.

The high position occupied by the decennial admission ratios of Bareilly, Sialkot, and Lucknow will be observed, and the low position of the ratios of Belgam, Aden, Calcutta, Bombay, and Rangoon. The enormously high 1898 ratio of Quetta is also striking, and the contrast which it presents to the ratios of Belgam, Colaba, &c., at the bottom of the 1898 list, as well as to its own corresponding decennial ratio.

In regiments the admission and death rates were highest in the cavalry; there was no enteric fever among the engineers, who are men of greater average age and service, and mostly married; and, next to them, the artillery suffered least. These results are the same as in 1897. The regiments which had an admission rate over 100 per 1,000 and a death rate over 40 per 1,000 were the 2nd Battalion of the Oxfordshire Light Infantry at Lundi Kotal, and the 1st Battalion of the Wiltshire Regiment at Quetta. The former returned from field service on the 9th April, and the latter was at Kurrachee the first three months of the year; and the former received 249 and the latter 200 men from England during the year.

With regard to the relation of mortality from enteric fever to age and length of residence in India, the general results confirm those of former years. The ratio of mortality from enteric fever per 1,000 of strength was greatest in the age period 20—25, and the relative liability of the same period was 44 per cent. In the same age-period the total number of deaths from enteric fever was 428, and out of 100 deaths from all causes 61 were from enteric fever. Lastly, out of the total number that died at all ages from enteric fever 74 per cent. were between 20 and 25 years of age. Again, the ratio of mortality from enteric fever per 1,000 of strength was highest in the first year of residence, and the liability in the same year was 38 per cent. In the first year the total number of deaths from enteric fever was 236, and 70 out of every hundred deaths from all causes were from enteric fever. Lastly, out of the total number that died at all periods of residence from enteric fever, 41 per cent. were in the first year of Indian residence.

The age period 20—25 included 51 per cent. of the total strength of the Army, and in the same period the liability to fall sick of enteric fever was greatest, 46 per cent. In the succeeding periods the liability rapidly declined. Again, though 18 per cent. of the men of the Army were of less than one year's service in India, 18 per cent. of more than 1 and less than 2, and 18 per cent. of more than 2 and less than 3, yet the liabilities of the men of these three equal percentages to contract enteric fever were respectively 43, 18, and 12. The greater has become the supply of susceptible material, the more enteric fever has prevailed.

In the period 1886–95 as a whole the chief enteric fever season, though the disease occurred in all months, was the six months April—September, with one maximum in May and another in August; and in 1898 the distribution was the same :—

YEARS.*	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	Ratio per 1,000.
1886–95	518	418	689	1,427	1,795	1,365	1,441	1,718	1,400	923	745	879	13,318	19·6
1898 ...	201	165	164	332	400	219	197	238	163	124	171	124	2,498	36·9

* The warning given at the end of the table of contents of the Annual Returns as to the months not being calendar months applies here also.

In 1898 the greatest prevalence of enteric fever was in April and May, and again in August; of simple continued fever in May and June, and again in August; of remittent fever in May, and again in July and August, an abnormal distribution which has already been noticed. Of the larger groups Gangetic Plain had maxima in January, March, April, August, and November; Indus Valley in January, April, and November; Deccan in April, August, and November; Central India in April and September; Hill Stations in May and August; and Upper Sub-Himalaya in May and December.

Plague.—In the European army of India there occurred 9 cases of plague, with 2 deaths, against 5 without death in the previous year :—

	Admissions.	Deaths.
Bombay (Colaba)	3	1*
Poona	2	0
Bangalore	2	1
Nasirabad	1	0
	8	2

* Out of hospital : 8 *plus* 1 = 9 *cases.*

All the men attacked at Colaba had been on plague duty. The fourth man affected died before arrival at the hospital. "It is believed that the virus obtained entrance to his system through a small chafe near the ankle. This became intensely painful, and, high fever with delirium occurring at the same time, death took place within a few hours of the invasion of the disease." At Poona two men of the 2nd Battalion of the Royal Irish Rifles were admitted, the bacillus being recognized in one. One of these men had been inoculated against plague in April, and contracted it in January. Fifty men of the garrison had been inoculated at the same time. Both the men had been employed in the city on plague duty, where they contracted venereal, and were both in hospital when their symptoms of plague appeared. The case at Nasirabad was in the person of a soldier of the 27th Field Battery, Royal Artillery, who had just arrived from England. He was detained in Bombay for some time before proceeding up-country, and when he arrived at Nasirabad it was found that he was suffering from plague. The patient recovered, and the disease did not spread.

Tubercle of the Lungs.—The admission-rate from tubercle of the lungs fell, while the death-rate was slightly raised. Contrary to the experience of the past two years the Bombay Command and the Gangetic Plain group had the highest admission ratios. The medical officer at Dinapore notes the share of syphilis in predisposing to vulnerability, and the medical officer at St. Thomas' Mount the influence of exposure during field service. Several officers mention the fact that a case of tubercle of the lungs is apt to yield more than one admission. In the reports from the stations where ratios were highest there are no further remarks of interest or importance. Ten cases, without death, of non-tubercular phthisis were returned.

Only for the two years 1897–98 can European and Native troops be compared with exactness in the matter of tubercle of the lungs, and the following table shows the comparison for India and for each group :—

1897–98.

Groups.	Tubercle of the Lungs.				All Tubercular Diseases.		
	Admissions.		Ratio per 1,000.		Troops and Prisoners.	Admissions.	Ratio per 1,000.
	European Troops.	Native Troops.	European Troops.	Native Troops.			
Group I.—Burma Coast and Bay Island.	4	10	1·6	2·8	European Army { Men	587	4·3
„ II.—Burma Inland... ...	15	22	2·8	2·3	European Army { Women	34	5·4
„ III.—Assam	*	16	*	4·8	European Army { Children	27	2·4
„ IV.—Bengal and Orissa ...	16	21	3·4	3·5			
„ V.—Gangetic Plain and Chutia Nagpur.	45	50	3·3	4·2	Native Army ...	829	3·2
„ VI.—Upper Sub-Himalaya	76	150	2·9	5·3	Prisoners ...	1,847	8·0
„ VII.—North-Western Frontier, Indus Valley, and North-Western Rajputana.	30	118	3·1	3·8			
„ VIII.—South-Eastern Rajputana, Central India, and Gujarat.	35	46	2·9	2·0			
„ IX.—Deccan...	69	61	4·0	1·6			
„ X.—Western Coast ...	9	14	3·0	2·5			
„ XI.—Southern India ...	18	27	2·7	1·7			
„ XII*a*.—Hill Stations	46	203	3·1	5·2			
„ XII*b*.—Hill Convalescent Depôts and Sanitaria.	21	*	3·3	*			
India	486	771	3·6	3·0			

* No Troops.

Much of the tubercle of the European troops is no doubt contracted in England. Accordingly, death from tubercle of the lungs is proportionately highest at the beginning and end of service, and at the earlier and later ages, while invaliding from it is most common in the intermediate period. With regard to Native troops, it must be remembered that Gurkhas, and perhaps Dogras, have high ratios, so that race, as well as location, has

to be considered. For example, Gurkhas preponderate in the garrisons of the Hills and Assam. High ratios have prevailed among the European troops of the Deccan for some years past, and the explanations offered were not satisfactory. However, there is a great improvement in 1898. Speaking generally, it may be said that in the more northerly parts of India the Native troops, in the more southerly the European troops, suffered more. The ratios from all forms of tubercular disease taken together were highest in prisoners, and next in European women, and the same had the highest and next highest ratios from tubercle of the lungs. The highest ratios for tubercle of the brain and its membranes, for tubercle in the abdomen, for tubercle of the lymph glands, and for tubercle of the bones and joints, were those of the children, prisoners coming second in the case of abdominal tubercle.

Flügge and his pupils have shown by experiment that the fine spray ejected from the mouth of a tuberculous patient in coughing may contain the tubercle bacillus, and is therefore a source of danger to others, a danger which may be averted by the polite habit of putting the hand before the mouth when coughing.

Respiratory Diseases.—Respiratory diseases caused more sickness and mortality than in the preceding year :—

Period.	Respiratory Diseases.		Pneumonia.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–95	30	·17	3	·60
1897	26	·70	3	·60
1898	29	·77	3	·61

Of the commands, the Punjab had, as usual, the highest death-rate. As to groups, the greatest prevalence was, as usual, in the Indus Valley. Only for a few stations of the most affected groups, VI., VII., and XII*b*., are explanations given in the reports. At Sialkot and Ferozepore the cases were mostly catarrhal ; at Mooltan, cold in the early morning and at night was blamed, while the medical officer of Rawalpindi says :—

The large number were, as usual, simple catarrhs ; 7* only were cases of pneumonia. This satisfactory return is considered to be due to réveillé being sounded at 7 a.m. instead of 6, which had been the hour in the earlier part of the winter of 1895–96. The decrease in the number of cases of ague in the weekly returns of January, 1896, after the change was made was very noticeable. It will be remembered that the altitude of Rawalpindi is over 1,700 feet, and that very cold winds prevail. The alteration of the hour of réveillé had unquestionably a wholesome effect on the health of the troops.

The admission-rate from pneumonia, though slightly lowered, was practically unchanged, while mortality rose a little. Of the commands, the Punjab had the highest death-rate, as usual. The Indus Valley was, as usual, the group in which pneumonia was most prevalent, the Hills and Upper Sub-Himalaya coming next. Nowshera and Peshawar had the highest ratios in the Indus Valley. At Peshawar the pneumonia is said to have been of a low type, attacking men reduced by malaria ; and in four of the cases both lungs were affected. The Tirah Field Force lost only three men in 1898 from pneumonia.

The number of European soldiers constantly sick from pneumonia was nearly 14, against 18 in 1897, and the average duration of a case, 27 days, against 31.

Dysentery and Diarrhœa.—The admission and death rates from dysentery and from diarrhœa fell very much, fell, in fact, to normal after the unusual elevation of the preceding year :

Period.	Dysentery.		Diarrhœa.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1886–95	30	·73	32	·06
1897	46	2·53	33	·23
1898	30	·78	27	·04

* Excluding a case of broncho-pneumonia.

Dysentery was most prevalent in the Bengal Command and in the Bengal-Orissa Group. The same group, but the Madras Command, had the highest percentage of dysentery in total cases, as may be seen in Tables on pp. 42 and 44. It is usual for Bengal-Orissa to have a high dysentery ratio. Dysentery was distributed with some degree of evenness throughout the months of the year, the maximum month being August and the minimum December; and Barrackpore, Dum-Dum (both in the Bengal-Orissa), Shwebo, Jubbulpore, as well as the plains depôts, had very high ratios. At Shwebo the cases were mild, at Jubbulpore the disease was "not traceable to any particular cause," at Dum-Dum it was ascribed to wet and damp. The medical officer at Barrackpore considers that even the imperfect measures hitherto carried out against the turbidity of the water and the water-logging of the soil have been productive of some good, and places his hopes for the amelioration of the disease on the completion of the drainage scheme.

Legge states that a virulent form of the *bacillus enteritidis sporogenes* (Gaertner) was the cause of an outbreak of "colitis" in the Derby County Asylum, and that a non-virulent form of the same bacillus was present in the sweepings from the wards. Others have found the *bacillus coli*, the *amoeba coli*, etc. But notwithstanding all that has been done, investigations into the causation of dysentery have not yet got beyond the grouping stage.

Hepatitis.—The admission and death rates from hepatitis, including abscess of the liver, rose from 20 and 1·32 respectively in 1897 to 21 and 1·59 in 1898.

Venereal Diseases.—From venereal disease the admission rate for India was 362·9, against 485·7 in the previous year and 511·6 in 1896. In other words, in 1898 for every 1,000 men there were nearly 123 fewer admissions to hospital for venereal disease than in 1897. From the reports of medical officers, it appears that this decrease was partly unreal, and due to the widespread adoption of the system of treating venereally-affected men as out-patients; and partly real, and due to the introduction of continuous and more prolonged treatment of the sick, to measures adopted under the new cantonment rules, to the placing of certain bazaars and cities out of bounds on account of the plague, and to the employment of a certain number of men on field service.

In 1898 there were 2,201·81 (against 2,991·59) men constantly sick in hospital from venereal disease—equivalent to over two regiments. Some medical officers specially notice the influence of the out-patient system in reducing the number constantly sick in hospital.

Excluding from the calculation (because data for them are not available) men on field service, and men of the Malakand Force and of the Khyber Force and Brigade, the average stay of a case of venereal disease in hospital was 33·31 days (against 33·32); and the total loss of service was about 803,661 days (against 1,091,930).

There were 17 deaths (0·25 per 1,000 of strength) and 569 invalidings (8·40 per mille)—against 23, or 30·4 per 1,000 of strength, and 662, or 9·68 per 1,000—*directly* attributed to venereal disease.

The ratio of venereal disease to strength increased in 17 stations and decreased in 87. The only ratio over 900 per 1,000 of strength was that of Shahjahanpur, a station which had the highest ratio in 1897 also. Next came the ratios of Fatehgarh, Pachmarhi, Dinapore, Saugor, Calicut, Benares, Amritsar, and Cawnpore.

The greatest increases of ratio (increases of more than 150 per 1,000) were at Pachmarhi in the Bengal Command, Lower Topa in the Punjab Command, Calicut in the Madras Command, and Ahmednagar in the Bombay Command. But the strength of some of these stations was low. The greatest decreases of ratio (decreases of more than 400 per 1,000) were at Sitapur and Chakrata in the Bengal Command, Solon in the Punjab Command, Shwebo in the Madras Command, and Nasirabad in the Bombay Command.

All the commands shared in the decrease. The Madras Command had the lowest ratio, and, as usual, the Bengal Command the highest.

In 39 stations (against 49) the admission rate for secondary syphilis was over 100 per 1,000 of strength; and in 47 other stations (against 21) it was over 75 per 1,000.

For India the ratio of primary syphilis *plus* soft chancre diminished by 56·7 per 1,000 of strength, the ratio of secondary syphilis by 14·8 per 1,000, and the ratio of gonorrhœa by 51·2 per 1,000. The secondary syphilis ratio had been increasing in the preceding two years.

In 1898 the Madras Command had the highest ratio for primary syphilis ; *plus* soft chancre, and, as usual, for secondary syphilis ; and the Bengal Command the highest ratio for gonorrhœa.

The following table shows the admission-rate for venereal disease as far back as the records for India as a whole permit. The heading " primary syphilis " includes the soft sore throughout :—

Year.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.	Year.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Disease.
1872	61·2	22·4	179·0	1886	157·9	33·3	389·5
1873	53·4	20·4	166·7	1887	142·1	29·4	361·2
1874	68·3	25·2	192·7	1888	142·1	32·4	370·6
1875	67·1	25·1	205·1	1889	225·1	51·2	481·5
1876	59·8	23·9	189·9	1890	220·7	66·3	503·5
1877	65·2	22·1	208·5	1891	159·2	60·0	400·7
1878	95·3	22·0	271·3	1892	161·1	57·8	409·9
1879	79·2	24·5	234·8	1893	213·6	61·6	466·0
1880	87·9	23·1	249·7	1894	248·1	74·6	511·4
1881	92·0	23·1	260·5	1895	239·0	84·9	522·3
1882	87·6	23·2	265·2	1896	226·4	97·7	511·6
1883	87·2	23·5	270·3	1897	201·7	101·9	485·7
1884	90·2	24·4	293·9	1898	145·0	87·1	362·9
1885	122·1	28·7	342·7				

The decrease in the total ratio continued, and the ratio of 1898 was the lowest since 1887. The secondary syphilis ratio also fell for the first time since 1892.

Invaliding.—In the whole army of India 2,580 men were invalided, or 38·09 per 1,000 of strength, against 2,258 and 33·01 in the preceding year, the increase being greatly due to the large number of men invalided for ague. The ratio for the decennium 1886–1895 was 24·34. The proportion of invalids to strength was lowest in the Bombay Command, and highest, as before, in the Madras Command.

Twenty-eight per cent. of the total number invalided were discharged as unfit for further service. The following table shows that this percentage was low. It should be mentioned, however, that the question in the case of each soldier as to whether the disability necessitates discharge is revised in England by a medical board ; so that the Indian figures do not show the real final disposal of invalids.

—	1894.	1895.	1896.	1897.	1898.
India	39	33	39	34	28

The following table shows the diseases which accounted for not less than 1 per 1,000 of strength :—

Invaliding Ratios per 1,000 of Strength.	—
Syphilis and gonorrhœa	8·40
Malarial fevers	7·16
Debility	2·69
Dysentery	1·87
Disordered action of the heart	1·80
Tubercle of the lungs	1·56
Valvular disease of the heart	1·45

The ratio of invaliding from mental diseases decreased, and was considerably below the decennial ratio as shown in the following table. There were 24 cases of melancholia, 12 of mania, and 24 of other forms of insanity.

	Ratios per 1,000 of Strength.	—
1886–95		1·19
1897		1·39
1898		·89

Invaliding according to age and Indian service.—The percentage of men who were invalided while under 25 years of age to the whole number invalided was 62, against 63 in 1897. The percentage of men under 25 in the strength of the army was 54, against 55.

Of the total number of men invalided, 33 per cent. were of less than two years' service, and 83 per cent. were of less than five years' service. With this is to be considered the fact that 82 per cent. of all the men in the strength of the army were of less than five years' service.

With regard to individual diseases the highest invaliding ratio per 1,000 of strength from venereal disease was in the age-period 20—25, and the relative liability for that period was 39 per cent. ; the actual number invalided for venereal disease in the same age-period was 353 ; of 100 invalided in the same age-period, 23 were due to venereal diseases, a proportion not quite so great as in the next age-period ; and of the total invalided for venereal disease at all ages 32 per cent. were in that same age-period. The residence period 1—5 years, and especially 3—4, had the largest proportion of invaliding for venereal disease.

Statistics of officers.

The vital statistics of officers show that the death-rate for the British Army was 16·26, and that for the Indian Army 10·18, both much lower than in the preceding year. The number of deaths from enteric fever was greater than in 1897 among British officers only, remaining the same in the case of Indian officers. Enteric fever caused, as usual, more deaths among the British than among the Indian officers, apparently because Indian officers have to serve first with British regiments, and it is known that youthful and newly-arrived men are more liable to take the disease than others. Another reason suggested is that food and drink, table and kitchen arrangements, are not so well looked after in British messes as in Indian.

The invaliding and death-rates were higher than for men, the admission-rate lower ; and the same was the case in 1897. The admission-rates from ague, tubercle of the lungs, and venereal diseases, and the death-rates from enteric fever and hepatic abscess, were lower than among the men. The chief causes of admission among officers were ague and simple continued fever ; and among the diseases with raised admission-rates were congestion and inflammation of the liver, simple continued fever, enteric fever, and influenza, the ratios from small-pox, cholera, malarial fevers, tubercle of the lungs, bowel complaints, abscess of the liver, and venereal diseases being lessened. Enteric fever was the chief cause of death ; the ratios from dysentery, circulatory diseases, and enteric fever being raised, and those from hepatic abscess, heat-stroke, and remittent fever reduced to zero.

There were only three cases of cholera, two at Thayetymo and one at Lucknow. There were 11 cases of enteric fever among the officers of the Tirah Field Force. The greatest numbers of cases of enteric fever at individual stations were 8 at Quetta, 7 at Murree, and 7 at Lucknow. Some hints as to the etiology of enteric fever at these and other stations will be found in pages 57 to 60. At Umballa one officer was admitted from the club, where the kitchen and scullery arrangements are said to have been very bad.

Statistics of women.

On the whole, the health of the women was somewhat worse in 1898 than in 1897, the rise in the admission and death-rates more than counterbalancing the fall in constantly sick :—

Period.	Average annual strength.	Admission-rate per 1,000.	Constantly sick rate per 1,000.	Death-rate per 1,000.
1886–95	31,881	815·2	32·1	17·00
1897	3,203	768·3	38·2	15·30
1898	3,118	772·9	37·9	16·04

The chief causes of admission were debility, ague, and the diseases peculiar to women. Among the diseases which caused increased admission were enteric fever, remittent fever, simple continued fever, influenza, respiratory diseases, and diarrhœa ; while from cholera, small-pox, ague, tubercle of the lungs, dysentery, puerperal affections, and the diseases peculiar to women, admission was lessened. Debility caused over 34 per cent. of the total sickness, and ague nearly 19 per cent.

The chief causes of death were enteric fever and puerperal affections. Among the diseases which gave increased mortality were enteric fever, hepatic abscess, puerperal affections, and malarial fevers. Mortality from cholera, tubercle of the lungs, pneumonia, and dysentery was diminished. Enteric fever caused 30 per cent. of the total deaths, and puerperal diseases 14 per cent.

Statistics of children.

That the health of the children was better than in 1897 may be seen from the following table, the fall in the death-rate more than counterbalancing the rise in the admission and constantly sick rates :—

Period.	Average annual strength.	Admission-rate per 1,000	Constantly sick rate per 1,000.	Death-rate per 1,000.
1886–95	59,695	581·8	22·7	46·72
1897	5,744	572·1	26·7	50·49
1898	5,592	606·6	28·8	41·13

The chief causes of admission were ague and respiratory diseases. Among the diseases with raised admission-rates were measles, whooping cough, ague, enteric fever, respiratory diseases, simple continued fever, diarrhœa, and eye diseases ; while admission from cholera, small-pox, remittent fever, influenza, tubercular diseases, and dysentery was lessened. Ague caused over 20 per cent. of the total sickness, and respiratory diseases over 11 per cent.

The chief causes of death were diarrhœa, convulsions, respiratory diseases, debility (including immaturity at birth) and teething. Among the diseases from which there was increased mortality were diarrhœa, remittent fever, enteric fever, diphtheria and croup. Mortality from cholera, small-pox, tubercle, teething, debility, respiratory diseases, convulsions, and dysentery was diminished. Diarrhœa caused over 22 per cent. of the total deaths, convulsions over 10 per cent., and respiratory diseases nearly 10 per cent.

Native Troops.

With a fairly normal year—a dry settled hot weather and monsoon rains above rather than below the standard in most parts of the country—the health of the Native troops was also fairly normal, and better than in the preceding year. Though there was an increase of influenza and respiratory disease, there was a great reduction in cholera :— **Sickness and mortality in 1898.**

Year.	Average strength.	Ratio per 1,000.							
		Admissions into hospital.	Constantly sick.	Deaths from					Mortality, including absent deaths.
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.	
1886–95 ...	123,302	976	34	1·32	1·34	3·02	·78	12·43	16·72
1897	129,802	839	31	·52	1·04	2·73	·67	13·12	14·90
1898	126,036	816	33	·33	1·08	3·77	·49	11·07	13·33

The chief cause of admission was ague. Among the diseases with raised admission-rates were influenza, remittent fever, respiratory diseases, and tubercle of the lungs. Among those with lessened rates were cholera, small-pox, dysentery, diarrhœa, and ague. Ague caused 41 per cent. of the total admissions.

The chief causes of death were pneumonia and remittent fever. Among the diseases which caused increased mortality were remittent fever, pneumonia, and enteric fever. Among those from which mortality was lessened were cholera, small-pox, ague, tubercle of the lungs, and debility. Pneumonia caused 34 per cent. of the total deaths, and remittent fever 10 per cent.

The total number invalided for discharge was 1,772, and the chief causes of invaliding were debility, malarial fevers, respiratory diseases, and venereal diseases.

If the following table be compared with that on page 24 it will be seen that the Native soldier suffered less from enteric fever, ague, remittent fever, simple continued fever, diarrhœa, hepatitis, and venereal disease ; equally from influenza and cholera ; and more from tubercle of the lungs, respiratory diseases, especially pneumonia, dysentery, and small-pox, than his European comrade. He also suffered more from scurvy. These relations are usual, except in regard to cholera, influenza, ague, remittent fever, and tubercle of the lungs.

Ratios of Commands.

—	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
I.—Average Annual Strength	25,036	42,515	22,575	24,520	6,304	126,036
II.—Constantly Sick rate	34·5	35·4	30·0	31·1	17·0	32·9
III.—Admission-rate :						
Influenza	9·4	8·0	14·6	5·0	1·7	8·3
Cholera	·7	—	·8	—	—	·3
Small-pox	·2	·3	·3	·1	·2	·2
Enteric fever	·4	·5	·2	·1	—	·3
Intermittent fever	309·7	409·1	253·2	365·5	199·4	335·0
Remittent fever	10·4	36·5	7·9	14·4	12·2	20·0
Simple continued fever	5·4	1·4	13·6	11·7	1·4	6·4
Tubercle of the lungs	5 8	4·1	2·2	2·5	·6	3·5
Pneumonia	14·5	25·3	7·8	12·7	8·2	16·5
Other respiratory diseases	22·0	33·4	19·1	32·7	10·9	28·7
Dysentery	40·3	60·5	20·0	41·8	13·3	44·0
Diarrhœa	7·7	12.0	3·1	12·6	1·1	9·4
Hepatic abscess	·1	·1	·2	·2	·2	·1
,, congestion and inflammation ...	1·3	1·0	1·6	1·9	1·0	1·6
Scurvy	·8	4·0	·3	3·8	1·1	2·8
Venereal diseases	53·7	28·9	49·7	43·8	28·2	40·0
All Causes	767·4	941·7	682·7	869·6	473·5	816·4

* Including those Imperial Service Troops that went on Field Service.

Ratios of Commands—continued.

	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
IV.—Death-rate :						
Cholera	·68	·14	·84	—	—	·33
Small-pox	—	—	·04	—	—	·01
Enteric fever	·16	·19	·13	—	—	·13
Intermittent fever	1·04	·47	·75	·20	·16	·58
Remittent fever	·68	1·62	·71	·77	·79	1·08
Simple continued fever	—	·02	—	·08	·16	·03
Circulatory diseases	·16	·12	·35	·20	·16	·20
Tubercle of the lungs	1·00	·80	·49	·38	—	·63
Pneumonia	2·84	6·52	1·59	2·08	1·59	3·77
Other respiratory diseases	·28	·43	·31	·37	·16	·36
Dysentery	·40	·64	·22	·53	·16	·49
Diarrhœa	·40	·19	·04	·12	—	·20
Hepatic abscess	—	·05	·04	·12	·16	·06
Anæmia and debility	·16	·05	·18	·16	—	·12
All Causes	10·03	13·38	9·92	7·79	5·08	11·07

* Including those Imperial Service Troops that went on Field Service.

Of the commands, the Punjab was the most unhealthy, and it was more unhealthy than in the previous year. Its death ratios from cholera, malarial fevers, and pneumonia were raised, while those from small-pox, enteric fever, tubercle of the lungs, and debility were lowered. The Punjab had the highest admission, the highest constantly sick, and the highest death-rate ; and the Hyderabad Contingent the lowest. The highest ratios of mortality from ague, tubercle of the lungs, and diarrhœa were in Bengal ; the highest from enteric fever, remittent fever, pneumonia, other respiratory diseases, and dysentery in the Punjab ; and the highest from cholera in Madras.

Burma.—The following table shows the statistics of all the native troops serving in Burma and the Andamans. Of these troops, in 1898 about 99 per cent. belonged to the Madras Army :—

Years.	Average annual strength present.	Ratio per 1,000.						
		Admissions into hospital.	Constantly sick.	Deaths from				
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.
1891	11,401	1,676	76	1·75	2·98	1·84	4·03	36·31
1892	11,333	1,349	57	2·29	2·29	2·29	3·09	29·12
1893	10,326	1,092	48	·87	1·45	2·42	1·36	19·85
1894	10,500	809	35	1·43	·95	1·14	1·43	13·90
1895	9,952	827	37	·80	·50	·80	·80	10·55
1896	9,605	830	38	—	·94	·73	1·35	9·58
1897	8,661	802	35	·46	·46	·92	·23	6·58
1898	7,195	800	31	·14	1·11	·42	·28	8·06

The table shows that the death-rate, which had been reduced year by year, went up somewhat in 1898, though sickness was less than in the preceding year. A comparison of the health of the troops in the Burma Coast group of stations with that of the troops in the Burma Inland group may be made by the use of the table on the opposite page.

Ratios of Geographical Groups.

	Ratio per 1,000 of the average strength.												
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
	Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalayan.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Army of India.*
I. Average Annual Strength	1,391	4,389	1,547	2,905	5,620	13,857	15,492	11,310	18,428	2,796	7,920	18,913	126,038
II.—Constantly sick Rate of the Year.	25·9	35·7	40·3	39·9	33·5	32·4	39·0	26·3	27·1	36·3	33·4	44·5	32·9
III.—Admission-rate:													
Influenza	35·2	10·7	—	38·2	2·5	5·2	·8	·4	7·5	—	16·8	19·5	8·3
Cholera	—	—	9·0	·3	·4	·3	—	—	—	—	2·0	·1	·3
Small-pox	—	—	—	—	·5	·3	·3	—	·2	—	·6	·2	·2
Enteric fever	—	·2	2·6	·3	·2	·1	·1	—	·1	—	·5	1·0	·3
Intermittent fever	156·0	538·4	296·7	521·2	256·4	316·7	499·5	259·6	272·6	176·3	190·5	525·1	335·0
Remittent fever	—	16·2	14·9	23·1	4·4	31·2	33·2	7·9	10·7	13·0	4·5	26·5	20·0
Simple continued fever ..	5·8	·2	6·5	6·9	4·1	·4	3·0	9·2	9·0	30·0	22·0	5·0	6·4
Tubercle of the lungs ..	5·0	2·1	6·5	5·2	5·0	6·0	3·9	2·9	1·6	2·1	2·3	6·0	3·5
Pneumonia	·7	1·4	14·2	5·5	6·0	23·2	35·8	13·3	8·5	7·5	9·2	25·3	16·5
Other respiratory diseases	16·5	30·3	20·0	27·2	19·9	22·3	44·9	21·3	14·5	32·9	18·7	44·8	28·7
Dysentery	71·9	19·1	101·5	52·7	47·9	32 5	70·6	23·9	20·3	58·3	13·3	64·5	44·0
Diarrhœa	7·2	5·2	20·0	6·2	6·4	8·1	12·4	6·6	2·8	12·2	2·5	19·5	9·4
Hepatic abscess	—	—	—	·3	—	—	—	·1	·1	·4	·4	·3	·1
„ congestion and inflammation.	·7	2·5	2·6	·7	·7	·9	·7	2·0	1·2	3·2	2·0	1·6	1·6
Scurvy	1·4	—	·6	1·7	·2	2·2	3·4	1·5	1·0	2·1	·1	3·4	2·8
Venereal diseases	48·2	54·5	102·1	45·1	48·6	40·7	22·0	40·1	52·0	57·6	45·6	54·1	40·0
All Causes ..	649·9	951·5	875·9	1,037·9	694·5	802·4	1,119·6	691·9	689·3	775·0	635·4	1,148·8	816·4
IV.—Death-rate:													
Cholera	—	—	8·40	·34	·18	·22	—	—	—	—	1·77	·11	·33
Small-pox	—	—	—	—	—	—	—	—	—	—	·13	—	·01
Enteric fever	—	—	1·94	—	·18	—	·13	—	—	—	·38	·21	·13
Intermittent fever	—	1·59	1·29	3·44	·18	·43	·52	·18	·27	—	·51	·74	·58
Remittent fever	—	1·59	1·94	1·72	·18	·87	2·07	·35	·87	2 15	·51	·63	1·08
Simple continued fever ..	—	—	—	—	—	—	·13	—	·05	—	—	·05	·03
Circulatory diseases ..	—	·46	—	·34	·18	—	—	·18	·11	—	·63	·48	·20
Tubercle of the lungs ..	—	·68	1·29	·34	·71	1·08	·45	·09	·38	—	·38	1·80	·63
Pneumonia	—	·46	1·94	1·03	1·60	4·55	9·04	2·56	1·90	·72	2·15	5·39	3·77
Other respiratory diseases	·72	·46	1·29	·34	·18	·51	·58	·27	·11	·72	—	·28	·36
Dysentery	·72	·23	1·29	1·03	·36	·65	·71	·09	·16	1·07	·25	·37	·49
Diarrhœa	·72	—	3·88	—	—	·22	·32	·09	·11	—	—	·05	·20
Hepatic abscess	—	—	—	—	—	—	—	—	·11	—	·13	·16	·06
Anæmia and debility ..	—	—	—	—	·18	—	—	·09	·16	—	·25	·32	·12
All Causes ..	5·03	8·89	27·15	9·98	4·98	10·39	15·75	7·25	6·29	12·88	12·37	14·00	11·07

* Including Group Extra-India.

Trans-Frontier stations.—The following statistics are those of the regiments stationed beyond the North-Western Frontier and in Baluchistan. The garrisons of Gilgit, Chitral, and the Malakand are not included :—

Year.	Average annual strength present.	Ratio per 1,000.						
		Admissions into hospital.	Constantly sick.	Deaths from				
				Cholera.	Remittent fever.	Pneumonia.	Dysentery.	All causes.
1898	9,468	1,492	44	—	1·06	8·56	·63	15·31

If this table be compared with that for India on page 69, it will be seen that the general ratios of the trans-frontier troops were considerably less favourable than those of India as a whole, a high death-rate from pneumonia being also a salient feature.

Geographical Groups.—The table which follows shows that for the decennium the highest constantly sick ratios were those of Groups II, III, I, IV, and XII, while the highest in 1898 were those of XII, III, and IV. Both for the decennium and in 1898 the mortality from respiratory diseases was greatest in the Indus Valley. Cholera mortality was below the decennial figure in all the groups except Assam and Southern India, and was highest in Assam :—

		Ratio per 1,000 of Strength.											
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
		Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia-Nagpur.	Sub-Himalaya. Upper	N. W. Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	India.
1886–1895.	Constantly sick rate...	48·9	65·8	62·8	48·2	28·9	31·6	37·1	27·6	28·3	23·4	26·2	42·3	33·6
	Death-rates from—													
	Cholera	—	4·47	·70	·59	1·14	·82	·80	·69	·87	·14	1·31	1·29	1·32
	Respiratory diseases	1·43	2·35	2·43	1·25	1·57	4·56	6·79	2·69	1·60	1·08	1·56	6·43	3·60
1897.	Constantly sick rate...	28·6	37·0	44·7	38·1	26·9	26·7	34·6	28·3	26·2	31·7	33·0	37·1	31·5
	Death-rates from—													
	Cholera	·45	·19	—	—	·48	—	—	·66	1·67	—	2·31	·10	·52
	Respiratory diseases	·45	1·49	1·68	·98	3·18	2·99	7·86	2·46	1·72	1·07	1·82	3·09	3·23
1898.	Constantly sick rate...	25·9	35·7	40·3	39·9	33·5	32·4	39·0	26·3	27·1	36·3	33·4	44·5	32·9
	Death-rates from—													
	Cholera	—	—	8·40	·34	·18	·22	—	—	—	—	1·77	·11	·33
	Respiratory diseases	·72	·92	3·23	1·37	1·78	5·06	9·62	2·83	2·01	1·44	2·15	5·65	4·13

In the table on page 71 it may be seen that Burma Coast had the lowest ratios from ague and pneumonia ; Burma Inland the highest from ague, and the lowest from simple continued fever ; Assam the highest from cholera, enteric fever, tubercle of the lungs, dysentery, diarrhœa, and venereal desease ; Bengal-Orissa the highest from influenza ; Indus Valley the highest from remittent fever, pneumonia, other respiratory diseases, and, along with the Hills, from scurvy, and the lowest from venereal desease ; Deccan the lowest from tubercle of the lungs, and from respiratory diseases other than pneumonia ;

Western Coast the highest from simple continued fever and from hepatic congestion; Southern India the highest from small-pox, and the lowest from dysentery and diarrhœa; the Hills, along with Indus Valley, the highest from scurvy. The comparative prevalence of enteric fever and venereal disease in Assam is due to the number of Gurkha troops there.

Stations.—Of the large stations throughout India with a strength of not less than 1,000, the following returned the highest death-rates:—Edwardesabad 40·61, Datta Khel 40·32, Dharmsala 24·33, and Meerut 23·87. The principal cause of death at Edwardesabad, Datta Khel, and Meerut was pneumonia, and at Dharmsala pneumonia and tubercle of the lungs. The garrison of Dharmsala is wholly Gurkha. Edwardesabad and Dharmsala were in the same black list in last report.

In answer to official inquiries regarding the recent outbreak of malaria at Aden, Major Anderson, I.M.S., an officer of long local experience, states his opinion that the sole cause was the heavy rainfall of 1889–90, the fever extending to places 50, 60, and even 100 miles in the interior, and that it will die out provided there is no more heavy rain. He regards chills as the exciting cause of the dysentery, though malaria and scurvy may be predisposing causes; and the climate as an important factor in the causation of the scurvy.

Principal Diseases: Influenza.—Attention having been directed to the health statistics of India, of the commands, of the geographical groups, of stations, and of regiments, it will be convenient now to consider some of the chief diseases. Influenza increased considerably, there having been 1,047 cases, 8·3 per 1,000 of strength, against 695 cases, 5·4 per 1,000 of strength, in the preceding year. This rise continues the alternation of fall and rise year by year which has obtained ever since the first outbreak of the disease in 1890. The geographical groups affected both in 1897 and in 1898 were II, IV, V, VI, VII, VIII, IX, XI, XII; I was newly affected in 1898, X was attacked in 1897, but not in 1898; while III escaped in both years. In proportion to strength the Bengal-Orissa group was most severely affected; and next to it Burma Coast, which had had no cases since 1892; but the greatest number of cases occurred in the Hills. The following table shows the monthly progress of the disease since its beginning in 1890. The maximum month varied from year to year, but over the period as a whole most cases occurred in April and March, and fewest in October and September:—

Years.	Number of Admissions into Hospital in each month.												Total.	Admitted per 1,000 of Strength.	Died per 1,000 of Strength.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.			
1890 ...	1	8	2,460	5,118	492	82	55	—	—	—	1	—	8,217	64·3	·41
1891 ...	—	—	1	—	105	259	123	106	51	22	17	215	899	7·0	·09
1892 ...	681	371	511	149	40	5	5	7	—	1	7	18	1,795	14·1	·15
1893 ...	8	28	65	99	95	13	9	7	—	3	53	404	784	6·2	·20
1894 ...	159	203	232	384	143	11	5	—	1	1	5	11	1,155	9·0	·16
1895 ...	26	28	53	76	110	25	60	57	19	17	31	408	910	7·0	·08
1896 ...	372	196	397	35	22	11	33	57	53	39	82	72	1,369	10·7	·30
1897 ...	97	61	100	117	84	79	22	—	42	67	23	3	695	5·4	·04
1898 ...	110	290	280	96	180	24	1	—	1	10	32	23	1,047	8·3	·03
Total	1,454	1,185	4,099	6,074	1,271	509	313	234	167	160	251	1,154	16,871	14·6	·16

Thirty-four stations were affected against 20; 27 being newly affected, 7 affected in both years, 13 affected in 1897 but not in 1898. The greatest number of cases occurred at Bangalore, Alipore, and Dharmsala. At Bangalore the disease was confined to February and March, at Alipore to January-March, and at Dharmsala to March-May. The following table shows that in 1898 the native troops, with exactly the same

admission-rate as the European troops, were, as usual, much less severely affected than the prisoners:—

Years.	Per 1,000 of Average Strength.											
	Influenza.						Pneumonia.					
	European Troops.		Native Troops.		Prisoners.		European Troops.		Native Troops.		Prisoners.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1890	33·4	·03	64·3	·41	78·6	·67	4·6	·90	16·7	3·96	18·5	5·71
1891	5·5	·04	7·0	·09	19·0	·29	2·6	·54	11·6	2·53	17·0	4·87
1892	12·7	·01	14·1	·15	56·7	1·26	3·5	·62	13·6	3·26	18·4	5·56
1893	·3	—	6·2	·20	6·4	·09	3·4	·70	12·3	2·75	15·9	3·95
1894	3·4	·01	9·0	·16	41·0	·43	3·7	·75	12·9	2·87	15·4	4·31
1895	7·8	·03	7·0	·08	20·3	·15	4·4	·51	17·5	4·20	16·4	4·00
1896	11·5	·11	10·7	·30	37·6	·60	5·2	·64	15·3	3·14	19·1	4·34
1897	4·0	·01	5·4	·04	8·4	·21	3·4	·60	13·0	2·73	15·6	4·24
1898	8·3	·01	8·3	·03	21·0	·33	3·3	·61	16·5	3·77	15·8	3·94

It also shows the relation of the pneumonia death-rate year by year to the admission rate from influenza, though, of course, the presence or absence of influenza is not the only circumstance which influences the pneumonia death-rate. The cases were mostly of a mild type, only four deaths being returned as directly due to influenza.

Cholera.—In the Native Army of India there were 48 cases with 42 deaths, against 112 cases with 68 deaths in the preceding year. The admission-rate was 0·3 against 0·8, and the death-rate 0·33 against 0·52. The only months quite free from the disease were August, September, and November; while the maximum was in June. The greatest numbers of cases occurred in Southern India and Assam, at Trichinopoly and Manipur. The regiment attacked at Manipur was the 44th Gurkha Rifles, and that chiefly affected at Trichinopoly was the 27th Madras Infantry. At the time the outbreak among the troops took place at Manipur cholera was raging in the valley, hardly a village round escaping. A committee, of which the president was the Principal Medical Officer, has insisted that the chief and most urgent want of Manipur is a pure, abundant, well-delivered, and properly protected water-supply. At Trichinopoly, too, the disease was prevailing in the neighbourhood when the troops were attacked, and the medical officer of the 27th states that it prevails every year from January to April.

Small-pox.—There were 26 cases of small-pox with 1 death, against 53 cases with 6 deaths in the preceding year. The admission ratio was 0·2 per 1,000 against 0·4, and the death-rate 0·01 against 0·05. In the Southern India group the cases bore the highest proportion to strength, but the maximum of cases (5) occurred in Indus Valley and Southern India. No station or regiment had more than 2 cases. The medical officer of the 7th Bengal Infantry states that the mild disease was quickly stamped out by the measures adopted, among them being special attention to vaccination, particularly among the followers.

Ague, Remittent Fever, Simple Continued Fever.—To ague was due over 41 per cent. of the sickness of the Native Army. Owing, no doubt, to the return of the seasons to the normal, the admission-rate from ague fell. The reduction was from 347 in 1897 to 335 in 1898. In 1898 Burma Inland was the most malarious group, and Burma Coast, as in the two preceding years, the least malarious; and the most malarious months were October and November, and the least malarious April and February.

Remittent fever caused nearly 10 per cent. of the total deaths, and prevailed most in August and least in December. The admission rate rose from 15·9 to 20·0, and the death-rate from 1·04 to 1·08. The medical officer of the 32nd Pioneers at Meean Meer, the regiment that had most cases, states that the disease was of a mild type. The proportion of cases returned as simple continued fever is much lower in the Native Army than in the European ; but it is pretty certain that many cases which in the latter would be so returned are in the former called ague. The simple continued fever of the Native Army was at its maximum in June, July, and May, and at its minimum in February, October, January. This was a good deal nearer the distribution of 1896 than that of 1897 had been, the seasons in 1898 having made a return to the normal. No remarks of importance are made by the medical officers. Some medical officers mention the prophylactic issue of quinine and other antiperiodics, and there is no doubt that this is a practice which ought to be strongly encouraged throughout the Native Army. There are three sets of opinions as to the results : that reduction of ague was effected, that no benefit was observed, that, while the number of cases was not reduced, the type of the disease was mildened.

Enteric Fever.—The ratio of admission from enteric fever in the Native Army in 1898 was 0·3 per 1,000 of strength, and the death-rate 0·13, against 0·4 and 0·12 in the previous year. The corresponding decennial ratios of 1886—95 are 0·2 and 0·08. The following table shows that the ratios for European troops are very unlike those for Native troops and prisoners :—

——	1886–95.		1898.	
	Admissions.	Deaths.	Admissions.	Deaths.
European troops	19·6	5·28	36·9	10·17
Native troops	·2	·08	·3	·13
Jail population	·3	·12	·2	·08

The next table indicates the fact that the total fever mortality in the two armies is not the same in amount, which proves that the difference is not altogether a mere matter of diagnosis :—

Causes of Death.	Died per 1,000 of Average Strength.		Relative Liability in Percentages.			Percentage in Deaths from all causes.	
	European Troops.	Native Troops.	European Troops.	Native Troops.	Total = 100	European Troops.	Native Troops.
Ague	·30	·58	34	66	100	1·5	5·2
Remittent fever	·37	1·08	26	74	100	1·8	9·7
Simple continued fever	·06	·03	67	33	100	·3	·3
Enteric fever	10·17	·13	99	1	100	50·7	1·2
Total	10·90	1·82	86	14	100	54·3	16·4

The total fever mortality among the Native troops in 1898 was to the total fever mortality among European troops as 1 : 6·0. For the period 1886—95, the corresponding ratio was 1 : 2·6, and for 1896 it was 1 : 4·2. Again, among the European troops 54 per cent. of all deaths in 1898 were from fevers ; only 16 per cent. among Native troops. See also Section IV, paragraph 104. As the death-rate of European troops from enteric fever in 1898 was nearly six times as great as that of Native troops from all kinds of fever, it appears, whatever may be the nature of the remittent and continued fevers from which Native soldiers died, that Native soldiers and prisoners were less liable to enteric fever than European soldiers.

The question of the immunity, or apparent immunity, of natives of India as regards enteric fever has been frequently discussed in former reports. For the opinion that natives of India are apparently exempt from enteric fever only because they have already passed through the disease in infancy, has not yet been adduced by the evidence of observed facts. But the medical officer of health of Hong Kong, after stating his belief that the alleged immunity of the Chinese is "probably due to an attack during infancy," goes on to say that the result of a careful search among the Chinese infants brought to the mortuary shows "that several such bodies have been found to present typical typhoid ulcers of the intestine." While the medical officer of Wachow returns a case in a Chinese in February and another in July, he of Chung King is still of opinion that enteric fever, pure and simple, does not occur there, though he records a case of "typhomalarial fever" in a European. Law describes two cases which may have been enteric fever in British Guiana among natives of the East Indies; but states that the disease is rare in the colony, and had never been met with in his own district. And Browne lays it down that the disease does not exist in British Honduras. On the other hand, in the Japanese Navy in 1896, there were 161 cases A *Lancet* leader adopts the view that the immunity of the Indian is real, and suggests that, for service in India, the darker complexioned Englishman of medium stature would probably be nearer the native of India in immunity than the big fair Englishman :—

> As compared with Europeans and the inhabitants of cold and temperate climates, the eastern and southern races, the Asiatic, African and mixed races, exhibit a relative immunity from . . . enteric fever, which plays such an important rôle in the medical history of all campaigns and expeditions in hot climates. Our experience in Egypt and elsewhere and that of the French in Algiers, Tunis, and other countries, have been to a similar effect. In the French expeditions, the Zouaves and troops with an admixture of Arab blood, and, in a less degree, the troops coming from Southern France, suffered less from this and other forms of fever than did those from the north. . . . Other things being equal, the nearer in physical type, temperament, and complexion the intending emigrants approach to the natives of warm latitudes in these respects the more likely are they to stand the climate and to prove healthier than fair-skinned men of larger stature. . . . For service in hot climates grown men of medium stature, spare frames, dark hair and complexion, and thick skins, may be expected to retain their health and to make the more efficient and enduring soldiers.

In the whole Native Army of India, 40 cases with 17 deaths were returned as enteric fever, as against 51 cases with 15 deaths in 1897. In not a single case does a *post-mortem* seem to have been obtained. Cases occurred in every month except November and December. The greatest number of cases was 10 at Kila Drosh, and no other station had more than three. In one of the Manipur cases the disease supervened on dysentery. At Kila Drosh exposure to the sun and fatigue are mentioned as factors in the causation; while various defects in water, milk, conservancy, etc., are pointed out, and it is stated that the Garhwalis were apparently, if not really, less liable to the disease than the Gurkhas proper. At Allahabad also exposure to the sun is mentioned; at Manipur, drinking of the prohibited water of the River Imphal; at Bakloh, impure water or milk; at Vizianagram, suspicious well water; at Madras, the drinking of impure water when at Pallavaram at musketry instruction. Two medical officers fear that, owing to the difficulty of diagnosis, they did not return all the cases of enteric fever that occurred in their regiments, having classed them as remittent fever, etc.

Plague.—In 1898 there were 94 cases of plague with 58 deaths, against 131 with 82 in 1897.

Respiratory Diseases.—Both morbidity and mortality from respiratory diseases were greater than in 1897; but allowance must be made for the fact that the ratios of 1897 were unusually low. Some of the increase at least was probably connected with the recrudescence of influenza :—

Period.	Ratio per 1,000 of Strength.			
	Respiratory Diseases.		Pneumonia.	
	Admissions.	Deaths.	Admissions.	Deaths.
1886–95...	50	3·75	13	3·02
1897	38	3·23	13	2·73
1898	45	4·13	16	3·77

Respiratory diseases are the chief cause of death in the Native Army, and in 1898 over 37 per cent. of all deaths were due to them. For respiratory diseases other than pneumonia the highest admission ratios were those of the Indus Valley and the Hills, and the lowest, as in the preceding year, that of the Deccan. Of commands, the Punjab had, as usual, the highest death-rate, and Bengal the lowest, except the Hyderabad Contingent. Non-pneumonic respiratory diseases were most frequent in the 16th Bombay Infantry while at Fort Sandeman, and in the 2nd Sikh Infantry and the 3rd Punjab Cavalry while at Kohat. Cold weather, cold winds, and chills are assigned as the exciting cause.

Pneumonia.—The admission and death rates from pneumonia, as may be seen from the table given in the preceding paragraph, rose considerably, and were above the decennial ratios. In the table on page 74 is displayed the relation from year to year between pneumonia and influenza. The admission ratio was highest, as usual, in the Indus Valley; and the death-rate was also highest there. Both in the Indus Valley and in the Hills, but especially in the former, pneumonia was most prevalent in the cold months; and the same was the case for India as a whole.

Dysentery, Diarrhœa.—From dysentery the admission-rate was much, and the death-rate considerably, lower than in the preceding year. The highest admission ratios were, as in the previous year, in the Punjab Command and the Assam group, and the highest death-rates in the same. The death-rate of Native troops from dysentery was to that of European troops as 1 : 1·6; and the percentage of dysentery in total deaths was 4·4 in the case of Native troops, and 3·9 in the case of European troops. Again, the case-mortality of Native troops was 1·05 per cent., while that of European troops was 2·29. The admission rate of Native troops was, however, as usual much higher than that of European troops, 44·0 to 29·8.

Venereal Diseases.—The following table is given to compare with the corresponding one for European troops on page 66.

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.
1877	11·5	5·3	26·7	1888	13·5	5·4	31·5
1878	16·3	5·8	37·5	1889	16·6	6·4	38·9
1879	16·5	7·0	37·1	1890	16·0	6·9	41·1
1880	15·0	5·8	33·3	1891	13·6	6·9	37·9
1881	17·9	7·2	39·5	1892	14·1	7·9	39·6
1882	14·7	5·9	34·4	1893	13·3	9·0	36·4
1883	13·0	6·5	31·6	1894	13·8	8·2	32·3
1884	11·0	5·3	27·9	1895	13·1	7·3	31·3
1885	11·2	5·9	30·1	1896	15·5	8·9	37·2
1886	13·7	6·0	28·1	1897	16·1	9·0	40·8
1887	12·6	6·1	27·4	1898	14·3	11·5	40·0

The figures for India are not available for the years before 1877. Primary syphilis includes the local sore throughout. All the venereal ratios of Native troops run at a much lower level than those of European troops; and they have remained comparatively steady during the years of which the statistics are given.

A comparison of tables on pages 42 and 69 will show that, leaving the Hyderabad Contingent out of account, the lowest ratios for both European and Native troops were, as in 1897, those of the Punjab Command. For European troops the Madras Command

had the highest ratio, and for the Native troops, the Bengal Command. In all the commands the ratios of Native troops were much lower than those of European troops.

Whilst among the European troops an average strength of 67,741 gave 24,585 admissions, in the case of the Native troops an average strength of 126,036 gave only 5,040 admissions. In other words, there were only 40 admissions for every 1,000 men among Native troops, against 363 for every 1,000 among European troops.

The admission-rate was 0·8 per 1,000 less than in 1897. There were 8 deaths and 99 invalidings *directly* due to venereal disease. In 36 stations out of 198 the admission rate from secondary syphilis was over 20 per 1,000 of strength, and in 44 other stations it was over 10 per 1,000 of strength.

For India the ratio of primary syphilis *plus* soft chancre fell by 1·8 per 1,000 of strength; that of secondary syphilis rose by 2·5, and that of gonorrhœa fell 1·5, the net result being a fall of 0·8 for all forms of venereal taken together, as noticed above.

Jails.

The health of the prisoners of India was much better in 1898 than in 1897. There was little cholera, though more influenza, and the usual chief heads of mortality, except phthisis pulmonalis, showed a reduction. The year 1898 was quiet, settled, and dry; the hot weather was hotter and drier than usual; the monsoon commenced slightly late, but quickly extended over the country, and gave rain in excess of the normal, or only slightly below it, to the greater part of India, the only regions of decided deficiency being parts of the Punjab, Rajputana, and Berar:—

Year.	Average strength.	Ratio per 1,000.									
		Admissions into Hospital.	Constantly Sick.	Deaths from							
				Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
1886–95 *	960,973	1,097	39	2·74	1·49	6·80	2·82	5·85	2·50	2·52	32·20
1897 * ...	118,107	1,045	41	3·94	1·08	11·07	3·17	5·19	3·02	2·35	38·75
1898 * ...	111,344	976	39	·13	·95	5·72	1·48	4·80	3·33	2·01	25·87

* Excluding subsidiary jails.

The chief causes of admission to hospital were ague, dysentery, abscess, and diarrhœa. Among the diseases with raised admission-rates were influenza, pneumonia, tubercle of the lungs, other respiratory diseases, and spleen diseases; while the rates from cholera, small-pox, debility, fevers, scurvy, and bowel complaints were lowered. Ague caused 35 per cent. of the total sickness, and bowel complaints 15 per cent.

The chief causes of death were dysentery, pneumonia, tubercle of the lungs, debility, and diarrhœa. Among the diseases with increased mortality was tubercle of the lungs. Among those with lessened mortality were cholera, small-pox, dysentery, diarrhœa, fevers, respiratory diseases, and debility. Dysentery caused 22 per cent. of the total deaths, pneumonia 15 per cent., and tubercle of the lungs 13 per cent.

Proportion of prisoners in population.—The following statement shows for each administration, except the Andamans, the proportion of prisoners in 10,000 of the population. Some of the prisoners of each province have been transported to the

Andamans, and these are necessarily excluded from the calculations, so that the ratios are all somewhat too low :—

Administrations.	Period.	General Population according to Census of 1891.	Prisoners.		
			Average Number.*	Proportion per 10,000 of Population.	Deaths per 1,000 of Average Strength.*
Burma	1897	7,605,560	13,435	17·7	24·12
	1898		12,674	16·7	20·59
Assam	1897	5,476,833	1,500	2·7	48·67
	1898		1,583	2·9	36·64
Bengal	1897	71,346,987	19,548	2·7	35·04
	1898		18,989	2·7	22·59
North-Western Provinces and Oudh.	1897	46,905,085	36,254	7·7	35·44
	1898		31,766	6·8	29·06
Punjab	1897	20,866,847	12,968	6·2	16·19
	1898		12,749	6·1	23·22
Bombay	1897	18,901,123	9,385	5·0	35·38
	1898		10,169	5·4	21·24
Berar and Secunderabad	1897	2,897,491	1,898	6·6	34·77
	1898		1,612	5·6	14·89
Central Provinces ...	1897	10,784,294	7,401	6·9	134·98
	1898		5,054	4·7	34·63
Madras	1897	35,630,440	10,312	2·9	47·32
	1898		10,938	3·1	26·24

* Including subsidiary jails.

The following table compares the ten administrations with each other, and the present of each administration with its past :—

—	Year.	Average Strength.	Ratio per 1,000.*									
			Admissions.	Constantly Sick.	Deaths from							
					Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
Andamans	1886–95	114,148	1,743	57	—	4·50	7·94	2·66	3·93	3·88	3·11	33·89
	1897	10,590	1,674	50	—	2·83	9·35	1·13	3·12	4·53	1·13	27·20
	1898	10,890	1,405	48	—	2·57	9·18	1·56	2·20	5·69	·83	27·09
Burma	1886–95	110,408	939	43	6·04	1·32	7·92	2·32	3·60	3·12	2·00	36·56
	1897	13,435	596	29	5·21	·52	5·21	1·71	2·23	2·46	·52	24·12
	1898	12,674	619	31	·47	·55	4·73	·71	3·47	4·18	·39	20·59
Assam	1886–95	11,550	1,758	58	5·19	1·99	14·37	7·71	5·54	1·30	4·42	52·90
	1897	1,233	1,028	52	5·68	·81	9·73	4·06	3·24	—	2·43	46·23
	1898	1,276	1,018	55	1·57	3·13	8·62	4·70	3·13	—	6·27	37·62
Bengal	1886–95	150,931	1,180	41	3·70	1·46	10·42	2·90	4·54	3·35	1·58	36·06
	1897	18,343	1,045	37	3·27	·87	10·47	1·96	4·47	3·43	·87	34·24
	1898	18,007	1,004	35	·17	·94	5·11	1·11	4·72	3·00	·67	22·77
N.-W. P. and Oudh.	1886–95	251,465	792	37	1·70	·65	5·60	2·40	6·02	1·96	2·06	27·54
	1897	35,890	1,012	50	1·28	·53	9·17	3·15	6·07	2·48	4·07	35·44
	1898	31,535	930	47	·03	·35	6·28	1·74	5·68	3·11	4·82	29·14
Punjab	1886–95	115,378	1,667	38	1·59	1·18	3·90	2·21	11·42	2·10	·61	30·23
	1897	12,785	1,336	31	—	1·02	2·66	1·17	5·00	2·11	·63	16·35
	1898	12,554	1,369	37	—	1·04	4·06	1·59	6·53	2·31	·24	23·50

* Excluding subsidiary jails.

—	Year.	Average Strength.	Ratio per 1,000.*									
			Admissions.	Constantly Sick.	Deaths from							
					Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Phthisis Pulmonalis.	Anæmia and Debility.	All causes.
Bombay	1886–95	68,265	757	28	1·48	1·74	3·56	3·56	9·10	1·74	2·12	30·18
	1897	7,767	846	29	5·28	3·22	3·22	3·60	8·75	2·96	·51	37·21
	1898	8,461	760	29	—	2·25	1·54	2·01	5·67	1·77	1·54	22·46
Berar and Secunderabad.	1886–95	11,539	756	22	·69	·95	2·08	1·13	5·46	1·13	·95	20·11
	1897	1,898	551	17	·53	·53	6·32	1·58	6·84	1·58	4·21	34·77
	1898	1,612	581	17	—	·62	·62	—	4·34	1·24	3·10	14·89
Central Provinces.	1886–95	43,798	936	31	4·73	1·21	11·39	5·23	5·75	1·94	3·36	42·65
	1897	7,401	1,233	65	4·19	1·49	64·72	18·65	10·13	4·86	9·73	134·98
	1898	5,054	1,142	52	—	·59	11·67	3·36	4·16	3·56	3·17	34·63
Madras	1886–95	78,363	723	27	5·32	·40	4·85	3·28	2·79	1·99	2·31	29·12
	1897	8,349	831	33	25·03	·36	6·47	—	2·99	4·19	·24	52·82
	1898	8,844	715	30	·23	—	5·88	—	4·30	4·41	·11	28·38

* Excluding subsidiary jails.

The prisoners of the Punjab alone were more unhealthy than in the previous year. In 1898 the three most unhealthy administrations were, in order, Assam, the Central Provinces, and the Andamans, and the three most healthy were, in order, Berar, Burma, and Bombay.

As compared with the decennial ratios, cholera mortality was everywhere, except in the always cholera-free Andamans, greatly reduced; the amount of reduction being greatest in Burma, Madras, and the Central Provinces; dysentery mortality was somewhat increased in five administrations, and greatly reduced in five, the reduction being greatest in Assam and Bengal, administrations in which high ratios are usual; diarrhœa mortality was reduced in all administrations, but especially in Madras and Assam. Mortality from respiratory diseases was diminished in all provinces except Madras and Bengal, the diminution being greatest in the Punjab and Bombay; phthisis mortality rose in all the provinces except Assam and Bengal, the rise being greatest in Madras, the Central Provinces, and the North-Western Provinces and Oudh.

It will be noticed in the above table that the provinces with total death ratios most below their decennial ratio were Burma, Assam, and Bengal; and that those with ratios most below the ratio of the previous year were the Central Provinces (less by 100·35, or 74 per cent.), Madras and Berar. Only the North-Western Provinces and Oudh had a death ratio higher than that of the decennium, and only the Punjab a death ratio higher than that of 1897.

The Andamans had the highest death-rate from tubercle of the lungs, and the lowest from pneumonia; Burma the lowest from respiratory diseases other than pneumonia; Assam the highest from cholera, ague, remittent fever, respiratory diseases other than pneumonia, diarrhœa, and debility, but no mortality from tubercle of the lungs; the Punjab the highest from pneumonia; Berar the lowest from dysentery; the Central Provinces the highest from dysentery; and Madras the lowest from debility.

In each hundred of the total deaths the proportion of tubercle of the lungs and of dysentery was greatest in the Andamans; of cholera and diarrhœa in Assam; of pneumonia in the Punjab; of remittent fever in Bombay.

The death-rates, or the known circumstances of the general population, and of the jail population, may sometimes be found to throw light one upon the other. If, for instance, the death-rate in a jail from dysentery and diarrhœa is strikingly higher than the rate recorded among the people in the surrounding district, the presence of a preventable cause at work inside the jail is suggested. Again, the presence of influenza in some of the jails actually gave a clue to the explanation of an extraordinary high death-rate from "fevers" in a certain province in the early part of a recent year.

The strongly held opinion of Lieutenant-Colonel Bate, Inspector-General of Prisons, Punjab, that the sickness and mortality occurring among the jail population in his province is to a great extent preventable, but that satisfactory results can only be obtained by unremitting attention to their duties on the part of those responsible for the welfare of the prisoners from day to day, is of general application. Careful attention to detail is essential to success in jail hygiene, as it is in most other matters; but it is vain to hope that the labours of medical superintendents, however capable and devoted, will entirely make up for the evil effects of bad sites and unsuitable buildings; and time and trouble have too often to be given to the treatment of patients, who, but for the condition of their surroundings, would never have been sick. The greatest care has been given to water-supplies for very many years, and the importance of good cooking has been recognized; but pure air is as necessary as pure water, and until it is possible to ventilate thoroughly the sleeping barracks in the cold nights of winter without chilling the occupants, there is no hope of banishing pneumonia from the jails, or of bringing respiratory diseases and tubercular affections within the limits to which they ought to be reduced. It is sometimes said that convicts are pampered, and in some few cases this may be true; but as long as jail death-rates remain as high as they now are, a general charge of this nature would be difficult to justify.

Andamans.—The Senior Medical Officer reports that all necessary arrangements have been made to meet the results of a possible importation of plague. It was found that hard labour in the cellular jail caused an alarming loss of weight in the convicts. He continues:—

> The vegetable supply is a weak point; it is extremely difficult to grow antiscorbutic plants in these islands, especially during the rains, and no indigenous plant of this description exists to my knowledge. The want of antiscorbutic properties in the vegetables is made up by an issue of tamarind, which is cooked in the food. Previously the tamarind was issued in a separate form; but the convicts, especially those from Northern India, disliked the acid taste, and did not eat it. Now they have no option in the matter. The result is satisfactory. Great efforts are being made to grow large quantities of limes, tamarinds, and such antiscorbutics as will grow freely in the settlement. .....The difficulties and defects in the water-supply have frequently been noticed, and have received a good deal of attention. Still, the water-supply is not satisfactory. The general system of supply is from rain and surface water collected in open tanks. The catchment area is protected, but rain water is not a satisfactory source of supply. .....No waters from the open tanks have ever given a good analysis, but they are potable. The defects are counterbalanced by the use of Larymore's patent boilers, and the use in certain cases of permanganate of potash. Still, the settlement may boil the water, but it is quite a different business to make the convicts drink it, especially in the rains. The water supplied to the 350 or 400 men employed intramurally suits the men, and no disease can be traced to it; in fact, these men are the healthiest in the islands.

Burma.—The average number of prisoners, which has been steadily decreasing since 1896, when the maximum was reached, fell to 12,674; but in spite of the decrease in the number of the prisoners in 1898 to a figure far below that for which accommodation is provided, there was chronic overcrowding in the jails at Insein and Henzada, and occasional overcrowding elsewhere. In spite of the reduction of its population, and the care bestowed on the "water-supply, feeding, clothing, and housing" of the inmates, the prison at Moulmein retains its reputation for unhealthiness. The very high admission-rates for bowel complaints in this jail are noteworthy. Owing to its unhealthiness it was finally reduced from the status of a central prison to that of a district jail in the first quarter of 1898. The Inspector-General of Prisons makes, from his long experience, some strongly favourable remarks as to the employment of jail gardens for the systematic disposal of the night-soil. Three of the jails, supplied with drinking water containing an unusual amount of solid matter and of chlorine per gallon, show no ill effects therefrom in the persons of their prisoners.

Assam.—The improvement in the health of the prisoners is attributed by the Inspector-General to the influence of the improved dietary; to the careful selection of prisoners for extramural labour; to the prophylactic administration of quinine and iron in the unhealthy season; to continued attention to the dieting and treatment of the weakly; and to the almost complete absence of cholera, from which there was only one death during the year. The Sanitary Commissioner of Assam points out, however, that 1898 was an unusually healthy year, and that the convicts shared in the general good health. That this is, in a measure, true is shown by the fact that the death-rate among convicts who had been for less than six months in jail, the number of whom averages more than all the rest of the convicts put together, was much the lowest. But a comparison of the mortuary statistics of the province as a whole with those of the jails during the last few years seems to indicate that much of the amelioration of 1898 was due to improved

hygiene. The Inspector-General convinced himself that the increase in the death-rate of Tezpur Jail was not due to the conditions of jail life or to want of care on the part of the officials, and that everything that could be done for the health of the prisoners had been done. Five of the deaths in that jail appear to have been due to *kala azar*.

Bengal.—The most noteworthy features of the year were the large decrease in the number of prisoners admitted, accompanied, however, by only a moderate decline in the daily average number of convicts; a remarkable immunity from severe outbreaks of cholera or other epidemic diseases; a very moderate sick-rate; and the lowest death-rate recorded. The year was no doubt an exceptionally healthy one; but a study of the figures of recent years shows how much has been achieved by the earnest attention of the jail administration, and by the honest work of the executive officers. The jails of the province afford ample accommodation for the number confined, although the special provision for females under trial seems to be inadequate. Owing to the difficulty or impossibility of distributing short-term convicts and under-trial prisoners, the average numbers of the former were in excess of the accommodation provided in 14 jails, and of the latter in 19 jails, and it was unfortunately found necessary occasionally to utilize worksheds as dormitories. The Inspector-General of Prisons says:—

> In all the jails which I have visited I found the superintendents keenly alive to the importance of all the arrangements in connexion with the water-supply. . . . . The extensive works at Buxar for pumping water from the Ganges, and for filtering, boiling and distributing it, were nearly completed at the close of the year. Alipore [Larymore] boilers were supplied to Monghyr, Bhagalpur, and Purneah Jails. New Pasteur filters were put up in the Dinajpur and Jalpaiguri Jails; those at Dumka and Motihari are reported to work satisfactorily; while that at Bogra got out of order in October. All wells from which drinking water is drawn are cleared of silt during the hot weather, and are frequently disinfected with permanganate of potassium. Samples of the drinking water used in all jails were sent for analysis to the Chemical Examiner to Government.

North-Western Provinces and Oudh.—Owing chiefly to the improvement of the material condition of the people in these provinces, there was a considerable reduction in jail population. Not only were the numbers much less than in the preceding year, but the health of the newly-admitted prisoners was much better; and, as the year was an exceptionally healthy one, the only important general factors militating against the health of the prisons as a whole in 1898 were the legacy of weakly prisoners convicted in the preceding year, and the overcrowding that took place in nearly three-fifths of the jails, including the six central ones. Every effort was made to avoid undue crowding by transfers, but the difficulties were increased by the large number of long-term prisoners.

Punjab.—There was a marked deterioration in the health of the jail population of the Punjab, with a considerable increase in the prevalence of dysentery of a severe type. The Inspector-General considers that, speaking generally, this is ascribable to the serious deterioration of health caused among prisoners by the prevalence of malarial fevers during the autumn of 1897; and thinks it also possible that the robustness of the prisoners received in 1897 and 1898 had been more or less impaired prior to admission to jail by the scarcity that prevailed in the province during the former year. The vital statistics of the provincial general population fully confirm this theory. There was a relationship between the death-rates of the civil population and of the convicts, but the relationship was in kind rather than in degree. The same diseases and the same seasonal influences acted effectively on both, but not in the same proportion; and there seems to have been some unfavourable condition of jail life at work. Cases of pneumonia were far more numerous than in 1897, and the increase in the Delhi Jail suggests special inquiry into the cause.

Bombay.—Difficulties caused by the presence of plague hampered transfers, and inevitable overcrowding occurred throughout the year in 10 out of the 15 jails. Some relief was afforded by the transfer early in May of 231 convicts to Sind, and, later in the same month, of 210 male life-convicts to Port Blair. Pneumonia in a bad form prevailed in the Sind gang in January; and the Shikarpur Jail, which, it is hoped, will soon disappear, and be replaced by a new prison at Sukkur, maintained its evil reputation for fatal pneumonia. On the other hand, in the Hyderabad Central Prison no prisoners died from diarrhœa, pneumonia, or other respiratory diseases, and only one, and that a man under trial, from dysentery. For the first time for 12 years there was no cholera in any of the Bombay jails, sub-jails, or lock-ups.

Berar.—With the return of prosperity there was a large decrease in the amount of crime, and the number of persons imprisoned was less than half the number imprisoned in 1897, and considerably lower than in any recent year. The reduction in the number of admissions to prison was not, however, sufficient to balance the great excess in the

population with which the year opened, so that the average strength in confinement throughout the year was greater than that for which accommodation is provided. The year was a peculiarly healthy one in Berar, and the convicts shared in the general good health. There was no plague, and little cholera; and scurvy also was almost absent from the jails.

Central Provinces.—Several jails were overcrowded at the beginning of 1898, but, as comparatively few persons were admitted to prison during the year, the gradual release of the famine convicts soon brought the numbers in confinement to normal, and before the end of the year accommodation in every prison was more than sufficient. The famine crisis of 1897, and the consequent admission of large numbers of starved and diseased prisoners, resulted in an abnormal rise in the sickness and mortality in that year. With the return of prosperous seasons and cheap prices, the distress and hardship of the previous year abated, but the ill effects of the famine continued to be visible in the new admissions to jail during the early months of 1898, and the sick-rate was high. The comparatively low death-rate with the high average sick-rate indicates either that the diseases from which the convicts suffered were much more amenable to treatment than formerly, or that prisoners were inscribed as admissions more freely than had hitherto been the case. The short passage quoted from the Inspector-General below conveys the idea that dysentery continues to be very fatal to the people in the district of Jubbulpore. This may be so in the case of adults, but the death-rate from bowel complaints among the people as a whole was lower than the corresponding ratio of the preceding quinquennium.

Privation in the district increased up to the end of 1897, and so did the mortality, not from general diseases, but from this one disease—dysentery. Deaths from this disease showed highest in 1898, and is still continuing, and 1899 will not see the end of it. The victims of chronic privation linger on for months, and apparently years, but that terrible anasarca developes.

Coorg.—There is only one jail in Coorg, that of Mercara. The health of the prisoners was not so good as in 1897.

Madras.—The price of food-grains continued very high, and was higher during the first half of 1898 than at any time during the previous year. High prices seem to have led to an increase of crime, for the number of prisoners admitted into the jails was greater than in any of the ten years preceding. This state of matters was fortunately not accompanied by any unusual sickness and mortality, there having been almost a complete absence of cholera, and a reduction in the sick and death rates. There were, however, extraordinary sickness and mortality in the Rajamundry Central Prison. There was some division of opinion as to the presence of beri-beri in this jail; and the medical superintendent, Captain Fearnside, I.M.S., has written an account of the investigations which he carried out into the causes of sickness and mortality among the prisoners, and ably maintains his thesis that the cases which have been considered to be beri-beri were not cases of that disease but of severe malarial cachexia. Whatever was the cause of the unusual sickness there can be no difference of opinion that the proper measures of improvement have been undertaken in reducing the general population, segregating the sick, sending the cachectic to other jails, and generally ameliorating the sanitary conditions of the jail, including the food-supply; and it is satisfactory to know that matters are mending.

Mortality of prisoners and of troops compared.—A table is, as usual, here given to compare the mortality of prisoners in 1898 with that of soldiers. Taking the death-rate of European troops as unit, the death-rate of Native troops will be represented by 0·6, and the death-rate of prisoners by 1·3. The mortality of prisoners was comparatively high as regards bowel complaints, anæmia and debility, respiratory diseases, and tubercle of the lungs. Only from fevers was the European soldiers' mortality highest. The enormously greater liability of the prisoners to death from bowel complaints is well shown in the table. Taking the mortality of the Native troops from fevers as 1, that of the prisoners is 1·1, and that of the European troops 6·0. Taking the mortality of the Native troops from bowel complaints as 1, that of the European troops is 1·2, and that of the prisoners 10·4. Taking the mortality of the European troops from respiratory diseases as 1, that of the Native troops is 5·4, and that of the prisoners 6·4. While the liability of the Native soldiers to die from respiratory diseases was less than that of the prisoners, yet these diseases made up a larger percentage of the total deaths among Native soldiers than among prisoners. The chief cause of death among European troops was fevers, among Native troops respiratory diseases, and among prisoners bowel

complaints. Of course, for obvious reasons, too much must not be made of the comparison here instituted :—

Causes of Death.	Died per 1,000 of Average Strength.			Relative Liability in Percentages.				Percentage in Deaths from all Causes.		
	European Troops.	Native Troops.	Prisoners.	European Troops.	Native Troops.	Prisoners.	Total 100.	European Troops.	Native Troops.	Prisoners.
Cholera	·21	·33	·13	31	49	19	100	1·0	3·0	·5
Fevers*	10·90	1·82	2·03	74	12	14	100	54·3	16·5	7·8
Bowel complaints ...	·82	·69	7·20	9	8	83	100	4·1	6·2	27·8
Spleen diseases... ...	·03	·01	·03	43	14	43	100	·1	·1	·1
Anæmia and debility ...	—	·12	2·01	—	6	94	100	—	1·1	7·8
Respiratory diseases ...	·77	4·13	4·89	8	42	50	100	3·8	37·4	18·9
Tubercle of the lungs ...	·58	·63	3·26	13	14	73	100	2·9	5·7	12·6
All other causes... ...	6·74	3·33	6·33	41	20	39	100	33·8	30·1	24·5
All Causes ...	20·05	11·07	25·87	35	19	45	100	100·0	100·0	100·0

* Enteric, intermittent, remittent, and simple continued fevers.

General Population.

General Remarks.—In this report for 1897, the subject of Indian vital statistics was discussed at some length, and an attempt was made to indicate the outstanding peculiarities of the statistics obtained in the various provinces, so that it is unnecessary this year to do more than note the more important features of registration in 1898. Each year carries us further from the day on which the census figures were recorded, and each year the ratios calculated upon those figures must become less accurate. It is important, therefore, to remember that, in a province where the population is rapidly increasing, the mere rise of birth and death rates to figures which have some appearance of being correct may not be entirely due to improved registration. Still, there is abundant evidence that the accuracy of the figures collected is improving, although improvement is by no means uniform, and much remains to be done, even with the existing agency, in many provinces, particularly in the towns.

Births.—The following statement furnishes a brief epitome of the birth statistics in 1897 and 1898, shewing the numbers of the urban and rural populations under registration ; the numbers of children born, the millesimal birth-rates, with the average rates of the previous five years ; and the percentages of male to female births.

Birth Statistics.

Province.		Number of Municipalities and towns in which births were registered.	Number of rural circles in which births were registered.	Population under Registration. In Municipalities and towns.	Population under Registration. In Districts, excluding towns.	Population under Registration. Total.	Total number of births registered.	Ratio of births per 1,000 of population.	Highest birth-rate in any one district.	Lowest birth-rate in any one district.	Number of males born to every 100 females born.	Excess or deficiency of births compared with deaths.	Mean ratio of births per 1,000 during previous five years.
Bengal	1897	148	557	3,444,512	67,625,105	71,069,617	2,625,844	36·94	47·40	18·46	106	+ 4·00	33·83
	1898	151	559	3,452,892	67,616,725	71,069,617	2,543,701	35·79	43·59	13·98	106	+ 9·22	35·61
Assam	1897	21	59	106,397	4,914,687	5,021,084	163,617	32·59	45·12	19·77	108·13	-18·02	31·39
	1898	21	60	106,397	4,914,687	5,021,084	147,889	29·46	38·18	18·66	107·65	- 6·69	31·70
North-Western Provinces and Oudh.	1897	97	1215	3,210,809	43,693,982	46,904,791	1,458,947	31·10	50·74	13·76	108·98	- 9·36	37·42
	1898	98	1,216	3,221,272	43,683,519	46,904,791	1,751,725	37·35	53·93	25·99	108·05	+ 9·97	36·41
Punjab	1897	151	447	2,013,969	18,540,013	20,553,982	874,623	42·6	57·5	19·3	110·5	+11·5	40·8
	1898	150	448	2,010,390	18,551,934	20,553,982*	841,869	41·0	53·8	21·8	110·4	+ 9·9	41·7

* Excluding Europeans and Eurasians.

Birth Statistics—continued.

PROVINCE.		Number of Municipalities and towns in which births were registered.	Number of rural circles in which births were registered.	POPULATION UNDER REGISTRATION. In Municipalities and towns.	In Districts, excluding towns.	Total.	Total number of births registered.	Ratio of births per 1,000 of population.	Highest birth-rate in any one district.	Lowest birth-rate in any one district.	Number of males born to every 100 females born.	Excess or deficiency of births compared with deaths.	Mean ratio of births per 1,000 during previous five years.
Central Provinces*	1897	72	161	811,710	8,689,691	9,501,401	254,973	26·83	46·30	16·23	107·76	-42·51	36·11
	1898	73	163	816,417	8,684,984	9,501,401	284,176	29·91	45·54	22·18	106·69	+ 5·61	33·80
Berar	1897	38	67	356,002	2,496,823	2,852,825	113,364	39·7	40·4	37·0	106·7	-12·9	37·6
	1898	38	67	356,002	2,496,823	2,852,825	89,414	31·3	33·6	28·4	105·2	+ 7·9	37·6
Madras	1897	93	179	2,538,033	30,060,268	32,598,301	935,845	28·7	41·6	20·8	103·9	+ 3·3	27·8
	1898	93	181	2,538,033	30,710,147	33,248,180	911,742	27·4	41·5	81·6	104·3	+ 6·4	28·5
Coorg	1897	5	5	15,511	157,544	173,055	3,503	20·24	26·12	15·36	100·74	-29·79	24·18
	1898	5	5	15,511	157,544	173,055	2,795	16·15	19·05	11·58	107·34	-15·28	24·18
Bombay	1897	63	220	2,304,373	16,515,973	18,820,346	629,693	33·46	44·11	11·29	108·42	- 6·38	35·51
	1898	63	220	2,304,373	16,515,973	18,820,346	582,371	30·94	42·33	13·08	108·19	+ 1·78	35·28
Lower Burma ..	1897	35	181	588,369	3,926,404	4,514,773	143,659	31·82	40·97	17·61	108	+ 6	27·96
	1898	34	196	582,692	3,928,005	4,510,697	153,838	34·11	45·24	18·77	109	+ 8	29·36

* Excluding Zamindaris of the Chattisgarh Division.

In 1898 the highest birth-rates were registered in the Punjab, 41·0 per 1,000, the North-Western Provinces and Oudh, 37·35, and Bengal, 35·79; and the lowest birth-rates were registered in Assam, 29·46 per 1,000, Madras, 27·4, and Coorg, 16·15.

In every province, except the North-Western Provinces and Oudh, the Central Provinces and Lower Burma, the birth-rates recorded in 1898 were lower than those recorded in the preceding year, and in only three provinces, Bengal, the North-Western Provinces and Oudh, and Lower Burma, were the rates higher than the averages of the previous five years. In only two provinces, however, Assam and Coorg, were the recorded births less numerous than the recorded deaths.

The percentage of male to female births ranged from 110·4 in the Punjab and 109·0 in Lower Burma to 105·2 in Berar and 104·3 in Madras.

Deaths.—The next statement gives details of the mortality in the different provinces in 1897 and 1898.

Death Statistics.

PROVINCE.		Number of Municipalities and towns in which deaths were registered.	Number of rural circles in which deaths were registered.	NUMBER OF DEATHS REGISTERED. In Municipalities and towns.	In Districts, excluding towns.	Total.	RATIO OF DEATHS PER 1,000 OF POPULATION. In Municipalities and towns.	In Districts, excluding towns.	Total.	HIGHEST DEATH-RATE. In Municipalities and towns.	In Districts, excluding towns.	LOWEST DEATH-RATE. In Municipalities and towns.	In Districts, excluding towns.	MEAN DEATH-RATE DURING PREVIOUS 5 YEARS. In Municipalities and towns.	In Districts, excluding towns.	Total.	Number of deaths of males to every 100 deaths of females.
Bengal	1897	148	557	120,875	2,220,757	2,341,632	35·09	32·83	32·94	89·59	49·92	14·20	23·62	33·78	32·03	32·11	118
	1898	151	559	94,980	1,793,488	1,888,468	27·50	26·52	26·57	52·84	41·50	9·98	15·29	34·15	32·23	32·32	117
Assam	1897	21	59	7,098	246,995	254,093	66·71	50·26	50·61	125·17	61·00	22·86	41·58	39·14	32·92	31·45	109·44
	1898	21	60	4,260	177,267	181,527	40·04	36·07	36·15	67·39	47·32	20·54	25·49	44·54	36·15	36·53	115·90
North-Western Provinces and Oudh.	1897	97	1,215	155,901	1,741,691	1,897,592	48·55	39·86	40·46	108·05	61·85	24·83	23·67	37·63	32·26	32·63	116·77
	1898	98	1,216	107,619	1,176,700	1,284,319	33·41	26·94	27·38	48·92	42·31	16·93	18·82	40·38	33·42	33·90	109·77
Punjab	1897	151	447	69,363	568,864	638,227	34·44	30·68	31·05	96·12	49·23	12·93	21·30	39·34	34·52	34·99	105·0
	1898	150	448	66,439	571,685	638,124	33·05	30·82	31·05	53·86	40·10	13·38	16·90	35·36	30·85	31·30	107·1
Central Provinces	1897	72	161	66,215	592,607	658,822	81·57	68·20	69·34	510·83	96·24	29·05	29·95	29·61	37·20	37·02	124·84
	1898	73	163	22,552	208,355	230,907	27·62	23·98	24·30	55·66	35·35	14·00	19·63	45·92	43·89	44·06	113·11
Berar	1897	38	67	20,451	129,771	150,222	57·4	51·9	52·6	92·2	60·5	21·8	41·6	39·34	39·6	39·4	117·6
	1898	38	67	9,086	57,720	66,806	25·5	23·1	23·4	34·7	24·6	15·6	20·3	not stated.	44·2	44·2	112·9

Death Statistics—continued.

PROVINCE.		Number of Municipalities and towns in which deaths were registered.	Number of rural circles in which deaths were registered.	NUMBER OF DEATHS REGISTERED. In Municipalities and towns.	In Districts, excluding towns.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. In Municipalities and towns.	In Districts, excluding towns.	TOTAL.	HIGHEST DEATH-RATE. In Municipalities and towns.	In Districts, excluding towns.	LOWEST DEATH-RATE. In Municipalities and towns.	In Districts, excluding towns.	MEAN DEATH-RATE DURING PREVIOUS 5 YEARS. In Municipalities and towns.	In Districts, excluding towns.	TOTAL.	Number of deaths of males to every 100 deaths of females.
Madras	1897	93	179	81,056	746,469	827,525	31·9	24·8	25·4	56·8	50·7	7·3	19·0	28·2	19·7	20·4	105·8
	1898	93	181	75,872	623,436	699,108	29·8	20·3	21·0	45·2	29·2	8·1	14·8	29·1	20·3	21·0	106·3
Coorg	1897	5	5	964	7,694	8,658	62·15	43·84	50·03	116·71	66·47	32·45	34·45	31·62	25·87	27·19	116·07
	1898	5	5	648	4,792	5,440	41·78	30·42	31·44	73·76	38·92	19·88	24·13	38·75	30·31	31·07	130·50
Bombay	1897	63	220	130,723	619,193	749,916	56·72	37·49	39·84	148·78	54·77	10·63	14·41	33·77	29·99	30·45	111·0
	1898	63	220	110,336	438,489	548,825	47·88	26·55	29·16	106·77	64·76	9·09	6·95	37·89	31·09	31·92	111·06
Lower Burma ..	1897	35	181	19,026	99,544	118,570	32·34	25·33	26·26	43·89	36·88	15·87	13·91	29·06	21·30	22·27	127
	1898	34	196	19,286	98,570	117,586	33·10	25·09	26·13	43·39	32·05	17·38	17·06	29·67	22·63	23·52	130

NOTE.—For population under registration, *see* preceding table.

The highest death-rates were 36·15, 31·44, and 31·05 per 1,000, registered, respectively, in Assam, the Punjab, and Coorg; and the lowest were 24·30, 23·4, and 21·0 per 1,000, registered in the Central Provinces, Berar, and Madras.

The year in most parts of the country was an extraordinarily healthy one, and in every province, except the Punjab and Lower Burma, the death-rates were lower, generally very much lower, than in the preceding year, while in every province save Madras, the Punjab, and Lower Burma, the rates were below the quinquennial averages. In the Punjab and Lower Burma the death-rates registered in 1898 were practically the same as those registered in 1897, the Punjab rate being very slightly in excess of the quinquennial average; and, although in Burma the rate registered in 1898 was considerably higher than the five-year average, the increase is largely due to improved registration. In Madras, registration continues defective, and the death-rate in 1898 was the same as the quinquennial average.

In every province the urban death-rates were higher than the rural. In every province, except Burma, the urban rates were lower than in 1897, and in every province, save the Punjab, the rural rates were also lower.

The following table exhibits the distribution of the mortality throughout the year :—

Statement showing the Deaths from all causes, according to Months, in the different Provinces of India during the year 1898.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1898.	1897.
Bengal	189,699	134,963	153,833	149,699	153,927	116,010	118,325	159,565	151,780	179,253	195,794	185,650	1,888,468	26·57	32·94
Assam	15,474	12,636	12,929	14,159	17,473	15,624	15,220	14,284	15,041	15,525	16,935	16,227	181,527	36·15	50·61
North-Western Provinces and Oudh.*	110,712	78,953	85,589	94,794	96,476	100,215	86,530	97,842	117,190	145,786	136,486	133,746	1,284,319	27·38	40·46
Punjab	58,358	41,973	43,539	44,578	53,537	55,469	45,334	49,861	55,083	64,467	64,618	61,307	638,124	31·05	31·05
Central Provinces*	24,427	18,543	17,940	18,424	19,445	15,978	14,366	17,847	18,641	22,406	21,034	21,856	230,907	24·30	69·34
Berar	6,707	5,035	5,589	5,507	4,554	3,301	3,913	5,588	6,381	6,370	6,763	7,098	66,806	23·4	52·6
Madras Presidency	80,757	58,128	54,290	49,617	50,090	50,332	56,591	57,097	55,421	54,441	62,327	70,017	699,108	21·0	25·4
Coorg	542	404	523	470	481	546	534	494	458	347	306	335	5,440	31·44	50·03
Bombay „	49,876	43,213	45,747	39,181	34,816	30,313	35,693	46,038	50,082	60,336	59,707	53,763	548,765	29·16	39·84
Lower Burma ..	10,835	9,118	8,960	9,029	9,101	9,507	11,126	10,955	10,024	9,842	9,688	9,671	117,856	26·13	26·26
Ajmer-Merwara ..	1,268	1,183	1,182	1,003	958	923	729	1,007	885	76	928	1,170	12,005	22·14	24·68
Mysore „ ..	8,855	7,509	9,543	8,955	6,621	6,370	6,780	6,753	6,755	8,798	9,605	10,248	96,792	19·98	17·94
TOTAL ..	557,480	411,658	439,664	435,416	447,479	404,588	395,141	467,331	487,741	568,340	584,191	571,088	5,770,117	27·13	35·62

* Excluding Zamindaris.

The mortality in every month of the year, except January, was less than in the preceding year, the total death-rate being only 27·13 per 1,000 in 1898 against 35·6 in 1897. The highest mortality occurred in the months of November, December, and October, in the order given, and the lowest in July, June, and February; the low mortality in June and July is noteworthy.

The following paragraphs contain a summary of the more important figures collected in the different provinces.

Bengal.—The total number of births registered in Bengal in 1898 was 2,543,701, or 82,143 less than in the preceding year; and the birth-rate, which declined from 38·03 per 1,000 in 1896 to 36·94 in 1897, fell still further to 35·79, which, however, is ·18 per 1,000 higher than the mean of the birth-rates recorded during the five years ending with 1897. The Sanitary Commissioner of the province ascribes the reduction in the birth-rate to the effect of the famine, "which lasted up to September, 1897, in some places, and to the high prices of food grains which prevailed almost up to the close of the year in several others." The Local Government does not, however, entirely endorse this view, and points out that, if the famine was the sole cause of the reduction in the birth-rate, there should be a reduction in the birth-rates of other provinces where famine prevailed, while in Bengal itself the reduction should be most distinctly marked in those districts most severely affected by famine. But this was not the case, for in the North-Western Provinces and Oudh, and in the Central Provinces, the birth-rates of 1898 were higher than those recorded in the preceding year, while in six of the fifteen districts, which were affected by famine in Bengal, the birth-rates of 1898 were higher than the birth-rates of 1897. It seems to be hinted that the postponement of marriages may have been the cause of the decline in the birth-rate in 1898, and an examination of the figures supports this view.

Famine may limit the natural increase of the people in several ways, three of which at least are obvious. If it is severe, it will exercise a directly unfavourable influence upon the fecundity of the very poor—it was noted in 1897 in Berar that women driven to the relief centres were rarely pregnant. Probably an even more potent factor is the absence from their homes in search of work of the heads of families. But even when famine is less severe, when the pinch of actual starvation is not felt, and few men are forced to leave their homes, a decline in the birth-rate is to be expected, for so far as caste usages will permit marriages will be deferred until the return of some degree of prosperity is assured. It is not easy, however, to determine the relative effect of these restraining causes, and in Bengal the rapid improvement of registration renders the comparison of the monthly birth-rates in 1898, with those of even recent years, difficult. If the monthly birth-rates from and including 1893 are examined, it will be found that a high rate in January is invariable—the maximum was recorded in that month in 1894; there is generally a fall in February, and a very distinct rise in March, after which the rates fall to a minimum in June, gradually ascending until September. In the last three months of an ordinary year, the rates are always high, and in one of the three, perhaps most often in December, the maximum of the year is generally reached.

In 1897 the monthly rates were fairly high, except in October and December, but in 1898 the rate in January was a low one, and the monthly rates remained low until August, after which they were much above the average until the end of the year, the rate recorded in November, 4·41 per 1,000, being the highest monthly rate recorded since 1892.

It is impossible to say how far the low rates in the first half of 1898 were due to the postponement of marriages, but there seems to be little room for doubt that the exaggeration of the normal rise in the latter part of the year was due to the consummation, when prosperity had returned, of numerous marriages which had been deferred during the persistence of hard times.

The highest district birth-rates were 43·59, 43·40, and 42·22 per 1,000, registered, respectively, in Murshidabad, Tippera, and Noakhali; and the lowest were 27·27, 26·87, and 13·98, registered in the 24-Parganas, Hooghly, and Calcutta. Calcutta is of course an urban district, but its birth-rate compares unfavourably with those of other towns, and with its own rate in 1897, which was 18·46. The falling off is attributed to the departure from the town of women for fear of plague. The average birth-rate in rural areas was 36·39, against only 24·02 in the towns. In some of the latter, notably Jangipur (44·82 per 1,000), Jamalpur, in Monghyr (44·05), and Jamalpur, in Mymensingh (42·11), the rates were high, but in the vast majority the rates were very low, the lowest being registered in Maniktala (9·61), Chittagong (8·84), and Jhalakati (8·45).

The causes believed by the provincial Sanitary Commissioner to account for the low rates in the towns are the following :—

(1) the preponderance of males in the urban population ;
(2) the presence of a large floating population ;
(3) the custom of women leaving the towns for their homes in the country for the purpose of being confined ; and,
(4) defective registration.

All these causes are, no doubt, more or less operative, not only in the towns of Bengal, but in most of the larger Indian towns, but it is of importance to discover how far each of the causes is operative, and what relation the fourth cause bears to the other three. In last year's report it was suggested in the case of Jhalakati, where the birth-rate of 1897 was only 2·11 per 1,000, that defective registration was mainly to blame for the low rate. Major Dyson has caused investigations to be made into the cause of the very low birth-rate in Jhalakati, and finds in the extraordinary condition of the small female population of the town cause for believing that registration there is as reliable as elsewhere in Bengal. From a statement given it seems that out of 399 females only 49 are married women capable of bearing children. But these figures are themselves suspicious. The census population of the town is 2,365, comprising 1,966 males and 399 females; and the number of females to which the investigation set forth in the statement relates is, very curiously, 399, exactly the same number of females that was recorded at the time of the census in 1891. But if registration in recent years was correct, the female population of Jhalakati, apart from immigrations, was only 351 in 1896, and if the same decline has been continued in 1897 and 1898, for which years there are no figures relating exclusively to females available, the female population in 1898 would be only about 341. The balance, of course, may have been made up by immigration, but this may be doubted in view of the fact that the statement showing the occupation of the female population includes neither infants nor children,

The provincial percentage of male to female births was 106, varying from 113 in Calcutta to 102 in Faridpur.

The total number of deaths registered was only 1,888,468, as compared with 2,341,632 in 1897, and the death-rate fell from 32·94 per 1,000 in that year to 26·57 in 1898, or 5·75 below the quinquennial average. The cause of the low death-rate was the exceptional salubrity of the year ; cholera mortality was only one-third of the average, and fevers and "dysentery and diarrhœa" were less fatal than usual.

The highest district death-rates were recorded in Noakhali, 40·99 per 1,000, Darjeeling, 39·73, and Chittagong, 36·99 ; and the lowest in Singhbhum, 17·28, Manbhum, 16·43, and the Sonthal Parganas, 15·33. In rural areas the average rate was 26·52 against 27·50 in the towns, among which the rates varied from 52·84 per 1,000 in Garulia, a small town in the 24-Parganas, which suffered severely from cholera, 49·54 in Malda, where fever was extraordinarily prevalent, and 44·72 in Serampore, where the deaths attributed to dysentery and diarrhœa were very numerous, to 12·82 in Cossipore-Chitpur, 11·26 in Raghunathpur, and 9·98 in Maniktala.

Among the various sects, Muhammadans had the highest death-rate, 29·53 per 1,000, and Christians the lowest, 17·69. The rate among "other classes," 17·89, was very little higher than that among Christians, while Hindus and Buddhists died at very similar rates, 25·51 and 25·61 per 1,000, respectively.

The largest number of deaths occurred in November, January, December, and October, and the smallest numbers in June and July.

Male infants died at the rate of 215·65 per 1,000, against 239·11 in 1897, and female infants at the rate of 170·28, against 194·14. The rates among boys and girls over one and under five were also lower than in 1897, 37·18 and 31·23 per 1,000, respectively, against 45·79 and 38·72, As usual, the male death-rates were higher in all age periods, the averages being 28·75 and 24·40 per 1,000 for males and females, respectively.

Port of Calcutta.—The number of European seamen who arrived in the Port during 1898 was 20,401, the average number in the Port being 1,232, or 30 more than in the preceding year. The total number of deaths among them was 28, equal to a death-rate, calculated on the average daily strength, of 22·72 per 1,000, against 33·27 per 1,000 in 1897.

Among the native floating population 122 deaths were reported during the year, which on a calculated average strength of 25,620 is equal to a death-rate of 4·76 per 1,000, as compared with 8·11 per 1,000 in 1897.

Assam.—The statistics from two mountain areas in Assam are treated separately from the general statistics of the province. These areas are the selected villages in the Garo Hills, with an aggregate population of 27,725, and Kohima, in the Naga Hills, with a population of 1,781. In the Garo Hills area, the birth-rate fell from 40·07 per 1,000 in 1897, to 36·25 in 1898, and the death-rate from 51·83 to 42·09. In Kohima the birth-rate, as in 1897, was 34·25 per 1,000, but the death-rate fell from 55·29 to 38·74. In the Brahmaputra and Surma Valleys, and in those portions of the Khasi and Jaintia Hills district which are under registration, the total number of births recorded was 147,889, or 15,728 fewer than in the preceding year, and the birth-rate fell from 32·59 per 1,000 in 1897, and a quinquennial average of 31·70 to 29·46. As in 1897, the highest district rates were recorded in Goalpara, Lakhimpur, and Sylhet, but the rates in 1898—38·18, 34·02, and 30·46, respectively—were very much lower than those recorded in the preceding year, which were 45·12, 35·17, and 35·17. At the other end of the scale, the same districts appear as in 1897, namely, Kamrup, Khasi and Jaintia Hills, and Nowgong, and in these districts also the rates recorded, 25·54, 24·55, and 18·66 per 1,000, were lower than in the preceding year. The average percentage of male to female births fell from 108·13 to 107·65, and ranged from 112·76 in Nowgong to 102·82 in Darrang, and 97·87 in the Khasi and Jaintia Hills.

The total number of deaths registered was 181,527 against 254,093 in 1897, and the death-rate, which in that year had reached 50·61 per 1,000, fell to 36·15, or ·38 per 1,000 less than the quinquennial average. Among the districts, the highest rates were 47·25 per 1,000 in Nowgong, 42·25 in Darrang, and 39·60 in the Khasi and Jaintia Hills; and the lowest were 31·78 in Cachar, 29·31 in Sibsagar, and 25·93 in Kamrup, where it is to be feared registration is very defective. In rural areas the average death-rate was 36·07 per 1,000, against an urban average of 40·04; the rates in the towns ranging from 67·39 in Golaghat and 61·54 in Hailakandi, to 20·54 in Maulvi Bazar.

Christians and Hindus died at nearly the same rate, 31·80 and 31·60 per 1,000, respectively, Muhammadans at the rate of 37·78, and "other classes" at the rate of 54·40.

The lowest monthly death-rates were recorded in February, March, and April; the highest in May, November, and December.

Male infants died at the rate of 198·04 and female infants at the rate of 181·30 per 1,000; and boys and girls over one and under five at the rates, respectively, of 37·71 and 36·12. In all age periods, save 20–30, the male rates were the higher, the averages being 37·58 for males, and 34·63 for females.

North-Western Provinces and Oudh.—The year 1898 was an exceptionally healthy one in the North-Western Provinces and Oudh; the birth-rate was not only higher than the quinquennial mean, but was higher by ·36 per 1,000 than the average of the five years ending with 1895, while the death-rate, with the exception of that registered in 1893, was the lowest on record. The total number of births registered was 1,751,725 against 1,458,947 in 1897, and the birth-rate was 37·35 per 1,000 as compared with 31·10 in the previous year, and 36·41 the quinquennial mean. Among the districts, the highest rates registered were 53·93 per 1,000, in Bulandshahr, 50·48 in Etah, and 49·26 in Budaun, all western districts; and the lowest were registered in Jaunpur 27·34, Mirzapur 26·12, and Azamgarh 25·99, all districts in the east of the province. In the municipalities the rates ranged from 57·32 in Sikandarabad, to 7·41 in Mussoorie. In every district, except Naini Tal, births were more numerous than deaths, although in Mainpuri and Mirzapur the excess was small. The percentage of male to female births, which in 1897 was 108·98, fell to 108·05, and ranged from 120·34 in Dehra Dun to 103·38 in Garhwal.

The number of deaths registered was 1,284,319, or 613,273 fewer than in the preceding year, and the death-rate, which was 40·46 in 1897, and averaged 33·90 in the previous five years, fell to 27·38. The highest district death-rates were 41·59 per 1,000 in Naini Tal, 41·49 in Bareilly, and 37·03 in Pilibhit; and the lowest were 22·05 in Azamgarh, 21·03 in Hardoi, and 19·11 in Gorakhpur. In rural areas the average death-rate was 26·94 per 1,000 as compared with 33·41 in the towns in which the rates ranged from 48·92 in Kashipur in the Terai, to 16·93 in Sahtawar. In 31 of the 104 municipalities the deaths were more numerous than the births, as compared with 76 in the preceding year.

Among the various sects, Muhammadans had the highest death-rate, 27·49, followed very closely by Hindus with 27·41; Christians died at the rate of 11·94 per 1,000, and "other classes" at the rate of 18·39.

The highest monthly death-rates occurred in October, November, December, and September in the order given, which correspond roughly with the months when the birth-rates were highest, namely October, December, September, and November. The lowest death-rates occurred in July, March, and February, and the lowest birth-rates in April, June, and May.

Among male infants the death-rate was 227·74 per 1,000 and among females 210·46, against 262·97 and 255·10 in 1897. The mortality among children between the ages of one year and five years, shows a much larger proportional reduction from 73·64 and 72·78 per 1,000 among boys and girls, respectively, in 1897, to 44·63 and 44·48 in 1898. At all age periods, except those between 15 and 20, and 20 and 30, males died at a higher rate than females, the average being 27·65 per 1,000 against 27·09.

Punjab.—The number of births registered in the Punjab in 1898 was 841,869 as compared with 874,623 in the preceding year ; and the birth-rate was 41·0 per 1,000 as against 42·6 in 1897, and 41·7 the quinquennial mean. The Sanitary Commissioner hazards the suggestion that the scarcity of 1897 was the cause of the decline of the birth-rate of 1898, but the Local Government points out that in the districts of Gujrat and Hissar, where famine was most severe in 1897, the birth-rates of 1898 were higher than those of the former year ; and, although the argument based upon this is somewhat discounted by the fact that the rates in these districts in 1898 were below the quinquennial averages, it does not seem probable that the famine accounts for much of the decline in the provincial average. If the rates registered in the districts in 1898 are compared with the averages in the same districts during the previous five years, it will be found that there was a great falling off in all the districts of the Derajat Division, especially in Dera Ismail Khan, but in the other divisions, the rates rose in some districts and fell in others, and there was no general fall or rise. Among the districts, the birth-rates ranged from 53·8 per 1,000 in Gujranwala to 21·18 in Simla ; from 53·4 in Jhang to 29·8 in Peshawar, and from 53·0 in Gurgaon to 30·6 in both Dera Ismail Khan and Dera Ghazi Khan. In Simla the sex distribution of the population accounts for a low birth-rate, but the extreme divergences elsewhere suggest defective registration. In the Derajat Division, for instance, there were fewer births than usual and more deaths. The unhealthy season caused the increased deaths, and may explain also the decrease in the number of births, not necessarily on account of any deterioration of the reproductive energy of the people, but because the presence of sickness would deter many of them from registering births. The percentages of males born to females, which in 1897 was 110·5, fell to 110·4, and ranged from 125·1 in Dera Ghazi Khan to 104·8 in both Delhi and Kangra.

The number of deaths registered in 1898 was 638,124, or 103 fewer than in the preceding year, the death-rates being practically the same in both years, 31·05 per 1,000, which is slightly less than the quinquennial mean of 31·30. Although the average death-rate of the province in 1898 was not far from the quinquennial average, the death-rates in the districts, except those in the Peshawar Division, show great divergencies from the quinquennial averages recorded in them. In all the districts of the Rawalpindi and Derajat Divisions, except in the Rawalpindi district itself, the rates in 1898 were above the average ; while in all the districts of the Delhi and Jullundur Divisions, except Gurgaon and Ferozepore, the rates were below the average. In the Lahore Division the lowest district death-rate was recorded, 21·3 per 1,000 in Montgomery, while in the same division the highest rate, with the single exception of Dera Ismail Khan (40·1), was also recorded, namely, 39·4 in Jhang. Other extreme rates were 37·9 in Karnal, and 21·6 in Simla, and 21·4 in Hazara.

The average death-rate in rural areas was 30·82 per 1,000, against 33·05 in the towns, in which rates ranged from 53·86 in Dera Ismail Khan, 53·16 in Bannu, and 52·04 in Gurdaspur, to 17·25 in Montgomery, 17·19 in Talamba in Multan, and 13·78 in Abbottabad.

By far the highest death-rate among the various sects was 79·61 per 1,000 registered among "other classes ;" but it is explained that this is not a real rate, and is due to errors in classifying. Muhammadans died at the rate of 31·19 per 1,000, and Hindus at the rate of 30·86 ; while far behind both come Native Christians with a death-rate of only 19·54.

As in the preceding year, the lowest death-rates occurred in the months of February, March, and April, and the highest in October and November.

Male infants died at the rate of 215·19 per 1,000 and females at the rate of 210·09, as compared with 223·02 and 228·02 in the preceding year. Boys and girls between one year and five years of age died, respectively, at the rates of 63·04 and 68·57 per 1,000, as against 58·4, and 66·76 per 1,000 in 1897. At all age periods, save in infancy and 40–50 and

50–60, the female death-rates were the higher, the averages being 29·89 per 1,000 for males, and 32·36 per 1,000 for females.

Central Provinces.—With the exception of the year 1894, when there was a slight rise the number of births recorded in the Central Provinces has declined year by year since 1892. In 1897, the total number registered was only 254,973, and it is satisfactory to note in 1898 a rise to 284,176, equal to a birth-rate of 29·91 per 1,000, as compared with 26·83 in the preceding year, and a quinquennial average of 33·80. The highest district birth-rates were 45·54 per 1,000 registered in Nimar, 45·01 in Sambalpur, and 39·63 in Chhindwara ; while the lowest were 26·17 in Seoni, 24.75 in Balaghat, and 22·18 in Saugor. In six districts—Nimar, Burhanpur, Betul, Nagpur, Wardha, and Chanda—the births were fewer than in the previous year ; but in only two districts, Saugor and Damoh, where scarcity still lingered, were the births less numerous than the deaths. The monthly distribution of births during 1898 is interesting. In the first seven months of the year, the birth-rates were much below the normal, far fewer indeed than in the corresponding months of 1897, and the usual rise in March and April was hardly visible ; but in August there was a rise, and in September the total had reached a figure in excess of any recorded in September since 1891. In October the number of births was almost exactly double that recorded in the October previous, and was the highest monthly total on record ; and exceptionally high figures were registered during the remaining months of the year. The percentage of male to female births was 106·69, ranging from 111·14 in Nimar to 101·85 in Raipur.

The number of deaths registered was 230,907 and the death-rate, which is the lowest on record, was only 24·30 per 1,000, as compared with 69·34 in 1897, and an average of 44·06 in the previous five years. Among the districts the highest rates registered were 33·64 per 1,000 in Nimar, 33·18 in Burhanpur, and 30·48 in Damoh—all considerably lower than the lowest rate recorded in 1897, with the single exception of Sambalpur which escaped the direct effects of famine. The lowest district death-rates in 1898 were 21·36, 20·69, and 19·72 per 1,000 recorded, respectively, in Raipur, Bilaspur, and Mandla. In rural areas the average rate was 23·98 per 1,000 as compared with 27·62 in the towns, where the death-rate ranged from 55·66 per 1,000 in Burha in Balaghat, and 44·96 in Khurai in Saugor, to 15·07 in Warora in Chanda, and 14·0 in Rajin in Raipur.

The provincial Sanitary Commissioner warns us that there is a doubt regarding the general accuracy of class registration, the results of which in 1898 shew the Hindus with the lowest death-rate, 22·44 per 1,000, and "other classes" with the highest, 34·07, while Muhammadans come in between with 27·12. In 1897 the rates were Muhammadans 52·61, Hindus 59·72, and "other classes" 126·23.

The largest numbers of deaths were recorded in the months of January, October, and December, and the smallest in July, June, and August.

Infantile mortality was unusually low, male and female infants dying at the rates of 240·11 and 205·45 per 1,000, as compared with the enormous rates of 403·00 and 356·11 registered in the preceding year. Boys and girls over one year and under five years of age died at the rate of 26·13 and 22·37, respectively, as compared with 79·64 and 63·78 in 1897. As seems to be invariable in the Central Provinces, the male death-rates were the higher at every age period, the average death-rates being 25·80 per 1,000 for males, and 22·80 per 1,000 for females.

Berar.—The number of births registered in Berar in 1898 was 89,414 as compared with 113,364 in the preceding year, and the birth-rate fell from 39·7 per 1,000 to 31·3, or 6·3 per 1,000 below the quinquennial mean. The highest district birth-rates were 33·6 and 33·2 per 1,000, registered, respectively, in Akola and Ellichpur, and the lowest were 30·5 and 28·4 in Amraoti and Basim. The number of births recorded exceeded the deaths in every district, the excess reaching 10·4 per 1,000 in Wun. The average percentage of male to female births, which in 1897 was 106·7, fell to 105·2, varying between 107·2 in Buldana and 103·0 in Amraoti.

The number of deaths fell from 150,222, in 1897, to 66,806, and the death-rate from 62·6 to 23·4 per 1,000, which is 20·8 per 1,000 below the average of the previous five years and one of the lowest death-rates recorded in Berar. In only two of the districts, Wun (20·4) and Basim (21·0) were the death-rates lower than the provincial average ; in the remaining districts the rates ranged from 25·1 in Akola to 24·0 in Amraoti. In rural areas the average death-rate was 23·1, against 25·5 per 1,000 in the towns, in which the extremes registered were 34·7 in Nandura, in Buldana, and 15·6 in Umarkhed, in Basim.

Christians and "other classes" died at the rates of 22·6 and 31·6 per 1,000, respectively; Muhammadans and Hindus at the rate of 23·4 and 23·1. The monthly mortality was highest in November and December, and lowest in June.

Male and female infants died at the rate of 194·8 and 166·8 per 1,000; and boys and girls, between one year and five years of age at the rates, respectively, of 46·0 and 41·0. In the age periods, 10–15 and 20–30, the female death-rates were the higher, at all other periods males died at the greater rate, the averages being 24·1 per 1,000 among males, and 22·7 per 1,000 among females.

Madras.—A falling off in the number of recorded births from 935,845, in 1897, to 911,742 reduced the birth-rate from 28·7 per 1,000 to 27·4, or 1·1 per 1,000 below the quinquennial average. As in the preceding year, the highest district birth-rates were recorded in Madras (41·5 per 1,000), Chingleput (35·7), and Kistna (34·2), but the rates, especially in the case of Chingleput, were lower in 1898 than in 1897. The lowest district rates were 22·9, 22·7, and 18·6 registered, respectively, in Ganjam, Madura, and Malabar; the decline in the birth-rate in Madura, where the average is 29·4, being due to the inclusion in the district statistics of figures from certain zamindaris. In rural areas the average birth-rate was 26·9 per 1,000, against 33·0 in the towns, among which the highest rates recorded were 54·5 in Vaniyambadi and 49·0 in Periyakulam. The percentage of male to female births rose from 104·0 in 1897 to 104·3, and ranged from 112·8 in Ganjam to 95·8 in the Nilgiris.

The number of deaths registered in 1898 was 699,108 or 128,417 fewer than in the preceding year, and the death-rate, which had reached 25·4 per 1,000, fell to 21·0, the same as the quinquennial average. By far the highest district death-rate was recorded in Madras, 45·2 per 1,000, and this was followed by 30·9 and 25·9 in the Nilgiris and Tanjore, respectively. The lowest rates were recorded in Malabar, 17·5, per 1,000, Godaveri 16·7, and Madura 15·6. The average recorded death-rate in rural areas was only 20·3 per 1,000 against 29·8 in the towns, where the rates ranged from 45·2 in Madras and 39·3 in Guntur and in Ootacamund, to 8·1 in Samalkote in the Godaveri district.

Among the different sects the highest death-rate was 21·3 per 1,000 registered for Hindus; Muhammadans followed with 18·9, then Native Christians 16·2, and lastly "other classes," 14·1.

The highest monthly death-rate was recorded in January (2·4); there was a considerable fall in February (1·8) and in March (1·6); the rates remained the same (1·5) during the next three months, to rise again in July, August, and September (1·7); there was a fall in October (1·6), but this was followed by a rise in November (1·9) and December (2·1).

Male infants died at the rate of 140·9 per 1,000, and females at the rate of 116·0; boys and girls, between one year and five years of age, died at the rates of 25·9 and 24·1, respectively. In the age period, 15–20, females died at a higher rate than males, 11·4 per 1,000 against 9·3, and in the next age period, 20–30, the sexes died at the same rate (10·3), but in all other age periods the male rates were higher, the average being 21·9 per 1,000 against 20·1.

Coorg.—The number of births registered in 1898 in Coorg was only 2,795, a smaller number than in any year since 1890, and the birth-rate of the year was 16·15 per 1,000, as compared with 20·24 in the preceding year, and a quinquennial average of 24·18. The rates in the various districts ranged from 19·05 in Kiggatnad to 11·58 in Mercara; and and in all the five districts the recorded births were less numerous than the deaths. The average birth-rate in the towns was only 7·67 per 1,000. The percentage of males to females born rose from 100·74 in 1897 to 107·34, and ranged from 117·48 in Nanjarajapatna to 97·10 in Yedenalknad.

Although deaths were much less numerous in 1898 than in 1897, 5,440 against 8,658, the death-rate was a high one for Coorg, 31·44 per 1,000, against an average of 31·07 in in the previous five years, which include the record death-rate of 50·03 per 1,000 in 1897.

The district death-rates varied between 37·63 per 1,000 in Nanjarajapatna and 24·13 in Kiggatnad. The average rate in rural areas was 30·42, against 41·78 in the towns. The latter are all very small, and the death-rates in some of them are enormously raised by the inclusion in the statistics of the deaths in the dispensaries of coolies, *e.g.*, the death-rate in Virajendrapett was 73·73 per 1,000, but of the 328 recorded deaths no less than 206 occurred in hospital, and 191 of the 206 were coolies on their way to or from the coffee estates. Similarly, if the deaths of coolies are deducted from the total number registered in Mercara, the death-rate of the town is reduced from 30·85 per 1,000 to 21·32.

Among Hindus, who form the vast majority of the population, the death-rate was 30·17 ; among Muhammadans it was 32·53, and among the smaller number described as "other classes" it was 83·50. The year began with a high death-rate in January ; there was a fall in February, but in March the mortality rose, to fall again in April, after which it rose to a maximum in June, falling month by month until December, when it again rose.

The death-rate among infants was 187·2 per 1,000 among males, and 157·08 among females, against 359·85 and 331·37, respectively, in the preceding year ; among boys and girls over one year and under five years of age, the rates were 35·26 and 30·50, against 77·06 and 78·41 in 1897. In the age periods, 10–15, 40–50, and 50–60, the female death-rates were the higher, and the average death-rates were 32·11 among males, and 30·59 among females.

Bombay.—The number of births registered in the Presidency of Bombay, including Sind, again shows a considerable decline from 691,847 in 1896, and 629,693 in the following year, to 582,371 in 1898. The birth-rate in 1898 was only 30·94 per 1,000, against 33·46 in the preceding year, and a quinquennial average of 35·28. The highest district birth-rates were registered in the Panch Mahals, 42·33 per 1,000, Khandesh 40·74, and Broach 40·49 ; the lowest in Ratnagiri, 24·52 per 1,000, Kanara 23·76, Hyderabad 16·96, and Bombay City 13·08. In rural areas the average birth-rate was 31·91 per 1,000, against only 24·05 in the towns, where rates ranged from 64·97 in Borsad, 52·0 in Kapadvanj, both in Kaira, and 50·59 in Nandurbar in Khandesh, to 12·64 in Sholapur, 12·27 in Ahmednagar, and 10·83 in Poona ; the low rates in the two last being ascribed to the exodus on account of plague.

The percentage of male to female births fell from 108·42 in 1897 to 108·19, ranging from 137·27 in Hyderabad to 101·95 in Dharwar. The smallest number of births was recorded in the month of February, and the monthly totals were much below the normals until August, when the number was about the average; but in the succeeding months the numbers born were far above the average, the maximum being recorded in October.

The total number of deaths registered was 548,825, or 201,091 fewer than in the previous year, so that in spite of the presence of plague, the death-rate fell from 39·84 per 1,000 to 29·16, which is not only lower than the mean of the previous five years, 31·92, but is lower by 1·29 per 1,000 than the mean of the five years ending with 1896, which include no year of exceptional mortality. The highest district death-rates were 64·03, 63·81, and 41·77 per 1,000 registered, respectively, in the City of Bombay, Dharwar, and Belgaum ; and the lowest 17·27, 14·58, and 11·04 per 1,000 in Upper Sind Frontier, Thar and Parkar, and Hyderabed. In rural areas the average death-rate was 26·55, against an average of 47·88 in the towns, among which the highest rates registered were 106·76, 93·25, and 69·08 in the plague-stricken towns of Belgaum, Gokak, and Hubli.

The highest death-rates were recorded among Parsis and Christians, 32·54 and 32·22 per 1,000, respectively, and the lowest rate among "other classes" 7·25. Hindus died at a much higher rate than Muhammadans, 30·71 per 1,000 against 23·76.

The monthly death-rates fell fairly regularly from January (2·65) to a minimum in June (1·61), then rose rapidly to a maximum in October (3·21), falling slightly to the end of the year.

Male infants died at the rate of 157·22 per 1,000, and females at the rate of 135·50 ; children between one year of age and five years at the rates of 42·84 among boys and 40·50 among girls. In the age periods 5–10, 10–15, 15–20, and 20–30, females died at the higher rate, the averages being 29·66 per 1,000 among males, and 28·63 among females.

Burma.—A slight reduction has been made in the population referred to in the registration returns of Lower Burma, by the exclusion from them of certain inaccessible tracts of the Toungoo and Mergui districts, which are patrolled only at irregular intervals. The average birth and death-rates in these tracts in 1898 were registered as 18·94 and 11·77 per 1,000 ; and, although these may be much understated, since, however, the aggregate population of the tracts is only 17,163, but little difference in the provincial returns results from its exclusion. In Lower Burma, the total number of births registered in 1898 was 153,838, more than 10,000 in excess of the total of the preceding year, and the birth-rate was 34·11 per 1,000, as compared with 31·82 in 1897, and 29·36 the quinquennial mean. Hitherto, 32·27 per 1,000, the birth-rate registered in

1896, has been the highest on record, and the increase of nearly 2 per 1,000 in 1898 affords evidence that the attention given in recent years to the improvement of registration in Burma is bearing fruit. But a good deal remains to be done as a comparison of the ratios obtained in the districts shows. In Myaungmya, Mergui, and Pegu, the birth-rates were respectively, 45·24, 45·09, and 41·49 per 1,000. while in Prome, Akyab, and Rangoon they were only 29·80, 28·58, and 18·77. The Rangoon district is entirely urban, and the male population is greatly in excess of the female, and there is a similar excess of males in the Akyab district; but in Prome, if the proportion of the sexes determined at the census has been maintained, there is a considerable excess of females, while in Myaungmya, Mergui and Pegu, males are the more numerous. The average birth-rate in rural areas was 35·34 per 1,000, very nearly 10 per 1,000 higher than the average of 25·78 registered in the towns, in which the rates ranged from 50·05 in Kawkareik to 15·02 in Akyab. In the province as a whole, 109 boys were born for every 100 girls, the percentages ranging from 115 in Rangoon Town district to 103 in Bassein.

The number of deaths registered was 117,856, and the death-rate was 26·13 as compared with 26·26 in the preceding year, and 23·52, the mean of the previous five years. The district death-rates varied between 43·39 per 1,000 in Rangoon Town district, where alone the deaths exceeded the births, to 18·40 in Mergui. In rural areas the average death-rate was 25·09, or about 8 per 1,000 less than the average in the towns which was 33·10, ranging from 43·39 in Rangoon and 41·91 in Pegu to 17·38 in Sandoway.

Among the different sects, by far the highest mortality was registered among the Hindus, who died at the rate of 37·51. It is explained that "this is due to the bulk of the Hindu population being made up of coolies, who, from the nature of their occupation, are specially liable to early breakdown. In towns they huddle together in overcrowded rooms, and in the district live in squalid huts not raised above the ground as Burman houses are." These conditions no doubt conduce to to a high death-rate, but as there can be proportionately few infants and young children among the coolies, they do not seem sufficient to account for a rise in the mortality among Hindus from 20·99 per 1,000 in 1895 to 25·15, 31·51, and 37·51 in the three succeeding years. Christians had the lowest death-rate, 16·25 per 1,000, after whom came Muhammadans with 23·60, "other classes" with 25·89, and Burmese with 26·08.

The lowest mortality occurred in March and April, and the highest in July and August.

Among male infants the death-rate was 287·35 per 1,000 living, as compared with 193·96 among females; boys and girls between one year and five years of age died, respectively, at the rates of 35·92 and 30·43 per 1,000. The death-rates of children have shown a progressive increase in recent years, due no doubt to the increase in the actual population, while that on which ratios are calculated remains the same. At all age periods, save between 30 and 40, the male death-rates were the higher, the average being 27·92 per 1,000 among males, and 24·12 per 1,000 among females.

In Upper Burma registration throughout 1898 was limited to nine towns with an aggregate population of 280,297, comprising 139,489 males and 140,808 females. The number of births registered was 9,546, or 34·06 per 1,000 of the population, but the variation in the rates was considerable, from 45·41 in Yamethin to 28·34 in Monywa, and 11·76 in Pagan. The average death-rate was 29·71, ranging from 36·44 in Pyinmana, to 16·63 in Pagan. The registration of births and deaths has been extended to three more towns, making twelve in all, and arrangements were completed to introduce the registration of deaths into selected districts.

History of Chief Diseases.

Cholera.

There is no discovery regarding the etiology of cholera to chronicle. In the greater part of India, as the following paragraphs will show, the disease remained in comparative abeyance throughout the year, a year of remarkable prevalence being succeeded by one of singular absence of the disease. We may congratulate ourselves on the fact, but we cannot explain it.

Anti-cholera inoculations were continued at the coolie-depôt at Purulia in Bengal, but it is not possible to say how far the inoculation was protective as there are no complete statistics, the Chief Commisioner of Assam having decided that it would be inexpedient to prescribe for preparation by the managers of tea-gardens of the half yearly returns to which allusion was made in this Report for 1897. If any conclusion is permissible from such figures as are available, it is decidedly in favour of the operation.

The disinfection of wells with permanganate of potassium, as recommended by Mr. Hankin, has become almost a routine practice in many parts of India in the presence of cholera. So far there is nothing on record to prove the utility of the procedure, but general impressions are almost universally favourable to it.

In 1897 there were 555,035 deaths recorded as due to cholera, and the death-rate, calculated upon the whole population under registration, was 2·55 per 1,000. In 1898 the number of deaths fell to 152,703, fewer than in any year since 1880, and less than the number registered in an average year in Bengal alone. The death-rate in 1898 in the country generally averaged ·70 per 1,000, and in every province, except Madras, the death-rate was much below the average. In Madras the deaths recorded numbered 65,444, a very striking contrast to the number, seven, registered in the adjoining Central Provinces. In the Punjab only 33 deaths were recorded, in Rajputana and in Hyderabad only six, in Central India only two, and in Berar not a single one.

The statement below shows the total numbers of deaths attributed to cholera in every province in India in each year from 1877 onwards :—

Statement showing the deaths from Cholera in the different Provinces in India from 1877 *to* 1898.

YEAR.	Bengal.*	Assam.	N.-W. P. and Oudh.	Punjab.	Central Provinces.	Berar.	Rajputana.	Central India.	Bombay.	Hyderabad.	Madras.	Mysore.	Coorg.	Lower Burma.	Ajmer-Merwara.
1877	155,305	11,377	31,770	29	3,418	842	60	926	57,228	7,414	357,430	2,902	‡	7,276	11
1878	95,192	6,732	22,221	215	40,985	34,306	2,393	8,047	46,743	6,696	47,167	723	49	6,759	210
1879	130,363	17,415	35,892	26,135	27,575	223	918	2,734	6,937	6	13,296	14	—	1,828	120
1880	39,643	2,803	71,546	274	330	1	—	299	684	—	613	25	—	2,638	3
1881	79,180	5,010	25,865	5,207	9,140	3,404	197	581	16,694	1,721	9,446	25	3	5,239	16
1882	182,362	21,055	89,372	39	11,932	3,573	1,327	1,562	7,904	150	23,604	893	31	7,177	289
1883	90,439	14,908	18,160	190	16,235	27,897	797	1,740	37,954	1,947	36,284	124	—	2,185	87
1884	134,421	22,276	30,143	614	149	87	1,297	1,018	13,804	2,479	75,476	330	—	5,515	227
1885	173,767	7,753	63,457	1,936	21,868	3,683	1,615	4,624	37,287	1,387	58,109	2,077	—	7,685	100
1886	118,368	20,188	34,565	12	16,679	976	173	290	187	499	12,417	10	—	4,027	765
1887	172,578	7,941	200,628	8,804	12,576	14,396	2,612	8,868	25,711	2,831	28,359	832	3	2,649	384
1888	111,391	9,693	18,704	14,938	921	305	32	191	36,500	2,057	58,677	1,015	2	15,982	13
1889	171,103	18,288	48,494	2,838	52,588	10,925	6,923	3,344	32,431	1,128	76,020	1,590	9	3,240	55
1890	145,885	15,396	80,295	3,401	4,787	847	2,746	3,132	3,259	—	35,288	1,326	5	1,076	18
1891	229,575	23,882	169,013	10,107	21,312	7,958	2,946	13,474	17,850	3,102	98,773	1,204	7	2,400	732
1892	259,398	21,552	194,886	75,959	39,972	2,030	26,760	8,384	42,900	53	79,033	5,497	58	6,208	2,352
1893	126,976	21,849	12,154	639	557	1,188	314	127	18,853	165	32,209	680	9	2,393	3
1894	236,150	13,497	178,079	113	7,043	3,452	2	5,210	33,588	1,862	42,289	328	8	7,428	—
1895	177,087	18,962	51,562	549	15,506	11,919	1,049	6,043	8,890	467	21,172	2,334	—	5,150	289
1896	226,824	17,042	69,147	5,146	52,985	12,264	3,797	15,766	35,404	525	47,847	2,100	49	2,959	12
1897	196,247	33,240	44,208	622	57,131	10,122	1,496	13,202	57,109	1,039	143,445	4,248	106	8,538	19
1898	65,020	11,149	2,508	33†	7§	—	6	2	4,368	6	65,444	1,193	8	2,972	1

* Excluding Calcutta from 1877 to 1892.
† Including 30 deaths in Cantonments.
‡ Statistics not available.
§ Excluding Zamindaries.

From the following statement of the seasonal distribution of the disease it will be seen that by far the largest number of deaths occurred in January ; there was a great fall in the mortality in February, continued in a slight degree in March, followed by a rise in April. The mortality again declined in May, and in June there was a remarkable fall, the low figures recorded in that month becoming gradually lower, except for a slight rise in

August, till the minimum was reached in October; a slight rise in November was followed by a great rise in December :—

Statement showing the Deaths from Cholera registered in the different Provinces by Months during the year 1898.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1898.	1897.
Bengal	11,730	6,723	6,831	12,748	10,710	3,338	1,052	867	639	1,849	2,678	5,855	65,020	0·91	2·76
Assam..	1,191	653	674	1,670	3,413	2,142	609	188	185	168	102	154	11,149	2·22	6·62
North-Western Provinces and Oudh.	81	92	52	173	188	190	70	145	181	503	595	238	2,508	0·05	0·94
Punjab	—	—	—	2	30*	—	—	—	—	—	—	—	33	0·002	0·03
Central Provinces†	—	1	—	2	1	—	3	—	—	—	—	—	7	—	0·01
Berar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3·56
Lower Burma ..	177	251	365	637	596	336	399	102	26	28	19	36	2,972	0·66	1·89
Madras Presidency	18,113	9,052	5,026	5,590	2,451	1,984	3,772	4,951	3,778	1,636	2,442	6,649	65,444	2·0	4·38
Bombay Presidency	113	36	167	518	495	697	631	719	523	348	89	32	4,368	0·23	3·03
Ajmer-Merwara ..	—	—	1	—	—	—	—	—	—	—	—	—	1	0·01	0·04
Coorg	—	5	3	—	—	—	—	—	—	—	—	—	8	0·05	0·61
Mysore	43	6	21	366	172	139	90	114	111	24	58	49	1,193	0·25	0·88
TOTAL ..	31,448	10,819	13,140	21,706	18,053	8,826	6,626	7,086	5,444	4,556	5,983	13,013	152,703	0·70	2·55

* These deaths took place in the Umballa Cantonment. † Excluding Zamindaries.

In the next statement the millesimal death-rates from cholera in the various provinces are contrasted with each other, and with the quinquennial averages; urban and rural mortality are compared; the percentages of villages attacked in each province are shown; the highest mortality in any single district and in any single town in each province is set forth; and the month of maximum prevalence in each province as indicated by the recorded death-rate is stated :—

PROVINCE.	Mortality in 1898.	Mean mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in any one district, excluding towns.	Maximum mortality in any one town.	Month of maximum prevalence.
Bengal	0·91	2·71	0·94	0·91	5·04	8·04	15·15	April.
Assam	2·22	4·17	1·87	2·23	13·67	3·46	6·57	May.
North-Western, Provinces and Oudh.	0·05	1·51	0·08	0·05	0·48	0·42	8·33	November.
Punjab	0·002†	0·07	0·001	...	0·005	...	0·07	May.
Central Provinces*	‡	...	...	...	...	...	...	July.
Berar	...	2·7	...	...	...	...	...	...
Lower Burma ...	0·66	1·17	1·14	0·59	4·20	1·44	7·46	April.
Madras	2·0	1·8	2·1	2·0	13·81	6·9	24·5	January.
Bombay	0·23	1·63	0·23	0·23	1·31	3·92	14·36	August.
Ajmer-Merwara ...	0·01	0·12	0·01	...	0·13	...	0·04	March.

* Excluding Zamindaries. † Including Cantonments. ‡ The total deaths numbered 7 only.

Bengal.—In Bengal in 1898 the number of deaths registered as due to cholera was 65,020, and it is necessary to go back for eighteen years to find so low a cholera mortality. In 1880 the number of deaths was only 39,643, but only twice since,

in 1881 when the total was 79,180, and in 1883 when it was 90,439, have the totals been less than a hundred thousand, and in most years they have been much more. The cholera death-rate in 1898 was ·91 per 1,000, less than a third of the rate of the preceding year, which was 2·76, and a little more than a third of the quinquennial average of 2·71. The low mortality is attributed by the provincial Sanitary Commissioner, chiefly to "the almost normal rainfall of the year, and the satisfactory agricultural outturn almost everywhere." Although in every district, with the exception of Chittagong and Purnea, the mortality was below the average, the disease was entirely absent from only one district, Palamau. It was absent from 130 of the 710 circles of registration, and was present in epidemic form in only eighteen. The highest district death-rates were 7·92 per 1,000 registered in Chittagong, 3·15 in Balasore, 2·70 in Tippera, and 2·20 in Bhagalpur. In Chittagong the high mortality seems to have been due to the conditions following the occurrence of the cyclone of October 1897. The disease was exceedingly prevalent in this district in January, it declined considerably in February, and still more in March, when the number of deaths fell to 566 ; a further decline to 128 occurred in July, after which cholera almost disappeared from the district.

In Puri, where the mortality, 9·57 per 1,000, was highest in 1897, the death-rate fell in 1898 to ·45, a fall which is attributed to "the improved sanitary condition of the place and to the opening of the East Coast Railway, which facilitated the rapid dispersion of pilgrims who congregate in Puri on the occasion of religious festivals several times a year." It may be noted that although deaths occurred in Puri in every month of the year, serious mortality was limited to the first four, and that the rapid dispersal of pilgrims did not lead to an outbreak of the disease elsewhere.

In the rural areas the average death-rate was ·91 per 1,000 as compared with ·94 in the towns. No less than 39 of the latter escaped the occurrence at any rate of fatal cases, and in other 24, deaths were limited to one or two. In a few small towns the mortality was heavy, notably in Garulia 15·15 per mille, Madaripur 6·60, Bajitpur 5·95, and Narayanganj 5·47. In Balasore the death-rate was 7·60 per 1,000, in Patna 1·60, and in Gaya 2·32.

Taking the province as a whole, the greatest mortality occurred in April, January, and May, and the least in September, August, and July. In the main divisions of the province there were, as usual, variations in the seasonal prevalence of the disease. The maxima in Bengal Proper occurred in January, April and May ; in Behar, in April and May ; in Orissa, in March and April ; and in Chota Nagpur in March. The minima were recorded in Bengal Proper, in September, August and October ; in Behar, in January and February ; in Orissa, in September and November ; and in Chota Nagpur in December.

Three cases and two deaths occurred among the European seamen in the Port of Calcutta, equal to a death-rate, calculated on the average strength, of 1·62 per 1,000, by far the lowest rate recorded, at any rate in recent years.

Assam.—The number of deaths attributed to cholera in Assam was 11,149, equal to a death-rate of 2·22 per 1,000, about one-third of the rate in the preceding year and rather more than half the quinquennial average of 4·17. In every district the death-rates were much lower than in 1897, and in every district they were below the five years' average. The highest rate was 3·39 per 1,000 registered in Kamrup, and this was followed by the rates registered in the Surma Valley districts, 2·57 in Cachar, and 2·50 in Sylhet. The lowest rates registered were ·54 and ·55 in Nowgong and the Khasi and Jaintia Hills respectively ; in the remaining districts the rates varied between 1·86 in Goalpara and 1·48 in Lakhimpur. In rural areas the average death-rate was 2·23 per 1,000 against 1·87 in the towns. Among the latter there were six, including Shillong, in which no death occurred, and rates were high in only Karimganj 6·57, Habiganj 5·77, Dhubri 4·35, Sunamganj 3·50, and Silchar 3·19.

Among immigrant coolies the numbers of deaths, 26 on board steamers, and 58 at the depôts, were smaller than for years past ; but on the tea-gardens the cholera death-rate was higher than among the general population. There were in all 1,627 deaths on the gardens, equal to a death-rate of 3·57 per 1,000 of the census population, and to 2·53 per 1,000 of the population in 1898 calculated upon the immigration returns.

In the province as a whole, the greatest mortality from cholera occurred in May, June, and April and the least in November and December. The maxima in the Surma Valley occurred in May and June, and in the Brahmaputra Valley in April and May, the minima occurring, respectively, in November and September and in December and November.

North-Western Provinces and Oudh.—In these provinces the mortality from cholera was unprecedently low, only 2,508 deaths were recorded, the smallest number since the

introduction of trustworthy registration in 1871. The death-rate was ·05 per 1,000 as compared with ·94 in the previous year, and the quinquennial average of 1·51. No less than six districts seem to have escaped the disease altogether, and in a good many others, notably those of Meerut Division, the few scattered deaths that occurred may not have been due to true cholera. The immunity of the rural population, among whom the death-rate was ·05 per 1,000, may be gauged from the fact that from only 516 out of 107,132 villages was the occurrence of deaths reported. Among the population of the larger towns, 265 deaths in all were recorded, equal to a death-rate of ·08 per 1,000. In only two of the towns was the rate in excess of 1 per 1,000, Tanda 1·67, and Rudhauli 8·33, situated in the districts, respectively, of Fyzabad and Bara Banki, where the highest district rates ·43 and ·39 per 1,000 were recorded. The maximum prevalence of the disease occurred in November and the minimum in March.

Punjab.—Save for an outbreak in April, resulting in about 30 deaths in the Umballa Cantonment, the Punjab was practically free from cholera, only three cases being reported, two in April, in the town of Rewari, in the Gurgaon District, and one in Umballa City in September.

Central Provinces.—After the severe epidemics of 1896 and 1897, in which, respectively, 52,985 and 57,131 deaths were registered, the total cholera mortality in the Central Provinces fell to seven deaths. The incidence of cholera in these provinces is occasionally slight, but nothing approaching the low mortality of 1898 has been recorded since 1874, when the deaths numbered only 14. Of the seven deaths which were registered in 1898, four occurred in the district of Balaghat, two in April and two in July; two in Nagpur in May and July, and one in Saugor in February.

Berar.—After occasioning the comparatively high death-rates of 4·2, 4·3, and 3·5 per 1,000 in 1895, 1896, and 1897, respectively, cholera disappeared from the province in November 1897, and in 1898 not a single death was recorded as due to the disease. Although cholera has been continuously present in Berar for the last seventeen years, its complete abeyance is not unknown; in 1880 only one death was recorded—in Buldana; in 1874 only two, also in Buldana, and in 1873 no death was recorded.

Madras.—The total number of deaths attributed to cholera in Madras in 1898 was 65,444, and the death-rate fell from 4·4 per 1,000 in the preceding year to 2·0, as compared with a quinquennial average of 1·8. The death-rates were very high in the neighbouring districts of Tanjore (6·7), Trichinopoly (5·5), and South Arcot (5·2). These are irrigated districts, as also is Kistna, where the next highest rate, 2·9 per 1,000 was recorded. In Nellore, which adjoins Kistna on the south, the cholera death-rate was 2·8, but this district was affected by famine during the year. In thirteen districts the death-rates from cholera were under the average; and in Ganjam only 46 deaths were registered, in Anantpur only nine, and in the Nilgiris only one.

Although 29 of the towns escaped altogether, the average urban death-rate was 2·1 per 1,000 or ·1 per 1,000 higher than the rural rate. Among the towns some of the death-rates were very high, notably in Ramnad (24·5) and Palni (14·4), both in Madura; in Tiruvallur (11·3) in Tanjore, in Arcot (8·1), in Chidambaram (7·7) in South Arcot, and in Trichinopoly (7·3).

The largest numbers of deaths occurred in January (18,113), February (9,052), and December (6,649), and the smallest numbers in October (1,636) and June (1,984).

Coorg.—Only eight deaths from cholera were registered in Coorg, equal to a death-rate of ·05 per 1,000 of the population, against ·61 in 1897, and an average in the previous five years of ·20. The deaths occurred in February and March, seven in the Padinalknad taluk and one in the Mercara taluk.

Bombay.—The number of deaths registered as due to cholera in Bombay was 4,368, and the death-rate, which is the lowest since 1890, was ·23 per 1,000 against 3·03 in 1897, and a quinquennial average of 1·63. No less than 4,054 of the deaths occurred in the district of Dharwar, where the death-rate from cholera was 3·86 per 1,000. There were 104 cases in the City of Bombay, 97 in the Belgaum district, 79 in Kanara, and 15 in Kolaba. In the remaining districts there were only a few scattered cases; Khandesh, Nasik, Ratnagiri, Surat, Broach, Kaira, Panch Machals, and the districts in Sind escaping altogether—the Sind districts for the second year in succession. The town of Gadag-Betgeri in Dharwar suffered severely, 342 deaths, giving a death-rate of 14·36 per 1,000; and the next highest urban death-rate was 2·25 in Ranebennur in the same

district. Only 536 deaths occurred in the towns, and the urban and rural death-rates were identical. The greatest prevalence of the disease occurred in August and the least in December.

Burma.—The number of cholera deaths registered in Lower Burma in 1898 was 2,972, and the death-rate was ·66 per 1,000, as compared with 1·89 in the previous year, and a quinquennial average of 1·17. In every district save four, Akyab, Bassein, Tavoy and Toungoo, the district rates in 1898 were lower than the quinquennial averages, and the district of Mergui was free from the disease. The highest district rates were registered in Akyab, 1·84 per 1,000, Bassein 1·69, and Kyaukpyu 1·32. Although thirteen of the 34 towns were free from the disease, the urban death-rate, 1·14 per 1,000, was nearly double the average of ·59 recorded in rural areas, deaths being fairly numerous in the populous towns of Akyab (cholera death-rate 7·46), Bassein (4·06), Thayetmyo (2·81), Moulmein (1·20), and Prome (1·07).

There were 177 deaths recorded in January, after which the number rose to a maximum of 637 in April, declining steadily until August, when it dropped to 102, after which it fell to 26 in September and remained low until the end of the year.

In the nine towns in Upper Burma in which vital statistics are registered, there were only four deaths ascribed to cholera, three in Myingyan and one in Pagan.

Summary of cholera registers.—The troops and the prison populations shared in the general immunity from cholera enjoyed by the people; and the following paragraphs, compiled from the cholera registers of outbreaks among troops and prisoners, show that even when cholera did appear among them it was, except in a few instances, limited to sporadic cases.

Cholera occurred among European troops in nine stations, and there were in all 30 cases and 21 deaths—case-mortality 70 per cent. In only one instance, at Umballa, where there were 20 seizures and 15 deaths, was the disease present in epidemic form. Of the 20 seizures at Umballa, nine occurred among native followers and four of them recovered, but 10 of the 11 Europeans attacked died. In other stations six of the attacks were single, and four of these terminated fatally.

Among Native troops, cholera occurred in six stations among 10 bodies of men, one of which suffered on two occasions. There were in all 57 cases, of which 44 ended in death, case-mortality 77·2 per cent.

Only eleven jails suffered, four in Bengal, two in Assam, two in Madras, and three in Burma. There were only 18 cases in all, and it is doubtful if the disease was true cholera in at least five instances. There were, however, nine deaths, equal to a case-mortality of 50 per cent.

There was no special prevalence of diarrhœa at the time of the occurrence of cholera, except in one instance, when a fatal case of doubtful cholera occurred in the Tezpur Jail.

The statement below shows, in all cases where the details are available, the number of buildings occupied by the communities attacked, and the proportion which furnished cases of the disease:—

Communities.	Number of buildings occupied by communities attacked.	Number of buildings which furnished cases.	Percentage of buildings which furnished cases.
European troops	131	15	11·45
Native troops	805	31	3·85
Prisoners	91	14	15·39

No special relation between particular meteorological conditions and the occurrence of cholera was established.

In one fatal outbreak among Europeans, the first attacked was of intemperate habits, and the day before his seizure, had visited a house in the bazar where there was a case of cholera. The occupant of the adjacent quarters visited the patient and was himself attacked on the following day. He recovered, and there was no other case.

Among Native troops there was no case in which cholera was imported in the sense used in this Report, but in many instances cholera was present in the neighbouring bazars or villages.

In two Bengal jails, prisoners were attacked on the third and fourth days respectively, after their admission from villages where cholera was prevalent. In neither instance did the disease spread.

The next statement shows, for the cases in respect of which details are available, the numbers treated, the numbers of attendants on these cases, and the numbers and percentages of the latter who were attacked :—

Communities.	Number of cholera cases treated.	Attendants.		Percentage of attendants attacked.
		Number.	Number of these attacked.	
European troops and followers ...	30	78	0	0
Native troops and followers	56	118	0	0
Prisoners	16	63	0	0

Among the sanitary defects noted, only the following seem likely to have been connected with the occurrence of cholera. The water supply at Umballa was liable to pollution. At Manipur drinking water was taken from a river on the bank of which there are villages in which there were cases of cholera.

Seven parties of European troops were moved in five stations. No attack occurred after movement, the effect of which on the general health was satisfactory.

Native troops were moved in three stations: at Rangoon the movement was entirely successful ; at Umballa one case occurred after the move ; at Manipur nine cases occurred after the move, although the medical officer states that the movement was quite successful. The account of the proceedings at Manipur is confusing, but it seems that the men and their families were moved in six parties into separate segregation camps, and from there into a general camp. In the segregation camps three cases occurred, in at least one of which the disease must have been contracted in Manipur. In the general camp five cases occurred, after which the camp was shifted to another site where one more case occurred.

The outbreak among European and Native troops and followers at Umballa is of special interest, as there was no case of cholera reported among the general population, indeed, except for two deaths that occurred in the district of Gurgaon in April, the Punjab was apparently free from the disease. In these circumstances it is unfortunate that the accounts of the outbreak at Umballa are of a fragmentary character, and it is difficult to piece the fragments. A suspicious case occurred on the 28th of April, when a syce died in the station followers' hospital with symptoms resembling those of cholera. Another suspicious case in a native is stated to have occurred on the 29th April, in which a fatal attack followed a self-administered purge taken to relieve the effects of a dietary indiscretion. The first case recorded as cholera was that of a European artilleryman who was under treatment in hospital. On the 29th of April he absented himself from the hospital, and remained out for several hours. He drank some beer and was exposed to the sun. Half an hour after his return to hospital he developed symptoms of cholera, and died collapsed on the 30th. The second case, also a European artilleryman, was admitted to hospital on the 1st May, but no connexion with the first case was traceable. On the 3rd May a private and a native follower were attacked ; on the 4th, two privates ; and on the 5th, two other privates and a follower ; and on the same day the disease appeared among the 16th Bengal Cavalry.

The Umballa cantonment water-supply is conveyed in pipes, but these pipes are very leaky, so that in the rainy seasons the yield of water from the pipe is greater than the supply to the pipe. "The vibrio of cholera was found in the well used by the Government Model Dairy," but no case occurred at the dairy, and neither the milk nor the butter from the dairy appear to have been used by the natives who suffered.

The medical officers who report upon the outbreak, ascribe it to the polluted water-supply ; but beyond the fact that the pipes were leaky, and the water consequently liable to pollution, there seems to be no evidence pointing to the water as the cause of the cholera.

SMALL-POX.

The mortality ratio of India from small-pox was in 1898 more than two and a half times less than 1897, and nearly one and a half times less than the ratio of the quinquennium 1893–97. The highest numbers of deaths occurred in the months of March, February, and April; and the lowest in October, November, and September. The reduction of deaths in the months of 1898 varied from great to considerable; and the total number of cases for the year was only 62,517, against 167,318. Only in Lower Burma and Ajmer-Merwara was the mortality higher than in 1897; and only in Lower Burma was it also higher than the mortality of the quinquennium as a whole.

The following shows the mortality from small-pox in the different provincial registration areas of India in 1898, month by month :—

Statement showing the deaths from Small-pox registered in the different Provinces by Months during the year 1898.

PROVINCES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1898	1898	1897
Bengal	1,169	1,731	2,291	2,081	1,647	1,243	920	1,148	400	326	491	822	14,269	0·20	0·27
Assam	369	758	852	706	715	536	393	268	179	101	107	125	5,199	1·03	1·08
North-Western Provinces and Oudh	229	177	223	355	329	278	245	175	109	82	84	133	2,419	0·05	1·86
Punjab	323	363	367	479	886	927	604	326	216	166	148	193	4,998	0·24	0·78
Central Provinces*	52	43	75	95	156	110	119	92	70	29	22	63	926	0·09	0·38
Berar	58	104	129	109	64	34	31	16	7	7	13	20	592	0·21	0·22
Lower Burma	328	605	734	877	665	461	354	223	174	114	94	197	4,826	1·07	0·43
Madras Presidency	4,094	3,692	3,563	2,368	1,219	992	875	806	745	689	657	790	20,490	0·62	0·67
Bombay „	264	403	435	280	111	67	63	39	44	36	40	52	1,834	0·10	0·20
Ajmer-Merwara	7	25	30	33	79	93	41	13	—	1	13	74	409	0·75	0·29
Coorg	1	—	4	9	4	—	3	1	—	—	—	—	22	0·13	0·34
Mysore	777	741	790	608	563	609	647	559	415	271	238	315	6,533	1·35	1·47
TOTAL	7,671	8,642	9,493	8,090	6,438	5,350	4,295	3,666	2,359	1,822	1,907	2,784	62,517	0·29	0·77

* Excluding Zamindaris.

Bengal.—In Bengal the mortality ratio was reduced as compared with that of the previous year, though somewhat higher than that of the quinquennium. Statistics will be found in the above table. The greatest monthly numbers occurred in March and April, but they were lower than in the preceding year. Jalpaiguri rural district, as in 1897, had no small-pox mortality; Khulna had the lowest ratio; while Puri, which generally suffers much, returned the highest mortality. Regarding the severity of the disease in Puri, the Civil Surgeon, as quoted by the Sanitary Commissioner, says :—

"Small-pox was epidemic in a virulent form and claimed 5,508 victims, the largest number recorded of late years. . . . . The rapid increase from 1896 is remarkable. The disease seemed to spread up from Ganjam, and for the most part was worst in villages adjacent to the trunk road to Cuttack. It also took deep root in Bhubaneswar outpost, a hot-bed of obstruction to vaccination. It seems also to have spread in from the *mals* on the west side of the district, where I hear it has been fostered by the practice of inoculation.

Speaking at an outbreak of Cuttack in March, the Sanitary Commissioner declares that the practice of inoculation, which is still clandestinely carried on in many parts of Orissa, the unprotected condition of the neighbouring native States, and the opposition of the people to vaccination are the causes of these periodical outbreaks. Last year several inoculators were detected and criminally prosecuted, with the result that some were heavily fined and some sentenced to imprisonment. The highest town ratio was that of Colgong in the Bhagalpur district, and the town with the lowest ratio was Dacca. The year under review was the third year in which there had been no death from small-pox among the European seamen in the port of Calcutta. Among the native floating population also there were no deaths, against 8 in 1897.

Assam.—From the table given above it may be seen that small-pox mortality in Assam was lower than in 1897, but higher than the mortality of the preceding quinquennium as a whole. March, April, and February had the greatest monthly numbers;

and in the first and third the numbers were greater than in the preceding year. October, November, and December had the smallest numbers. The Sanitary Commissioner remarks that on the whole the disease has been very satisfactorily kept under by efficient vaccination. Of all the provinces except Madras, Assam had the highest rural mortality. The rural district with the highest ratio was Nowgong, and the lowest rural district ratio was that of Cachar. The highest and lowest town ratios were respectively those of Jowai, in the Khasi and Jaintia Hills, and of Sylhet. The outbreak at Jowai, which had spread from Gauhati, seems to have been stamped out by energetic vaccination operations.

North-Western Provinces and Oudh.—The statistics of small-pox in the North-Western Provinces and Oudh will be found on page 101. The mortality was about 37 times less than in the preceding year, and about 12 times less than the mortality of the quinquennium 1893–97 as a whole. The highest monthly numbers were those of April, May, and June; and the lowest, those of October, November, and September; and every month of the year had a very much lower number than the corresponding month of 1897. Of all the provinces this had the lowest rural ratio, and only in this province was the rural mortality lower than the urban. The highest rural district ratio was that of Gorakhpur, and the highest town ratio that of Mau, in the Azamgarh district.

Punjab.—Below both that of the preceding year and that of the quinquennium, was the small-pox mortality of 1898 in the Punjab. Statistical particulars are given in the table on page 101; every month of the year the reduction was great. The highest numbers were those of June, May, and July; and the lowest those of October, November, and December. The Sanitary Commissioner states that small-pox was much more prevalent from 1867 to 1879 than from 1879 to 1898; and points out that the latter period almost coincides with the age of the vaccination department as it is at present. The highest rural district ratio was that of Umballa; while Faridabad in the Delhi district had the highest town ratio, and Amritsar the lowest. The percentage of children's deaths in total small-pox mortality was, excluding Ajmer-Merwara, highest in the Punjab.

Central Provinces.—Small-pox mortality in the Central Provinces was much below that of the preceding year, as well as that of the quinquennium as a whole. The table on page 101 gives the necessary statistics. The maximum months were May, July, and June; and the minimum November, October, and February. Except in September and December, there were fewer small-pox deaths than in each corresponding month of 1897, the reduction being very great except in July, August, and November. The highest rural district ratio was that of Sambalpur, and the lowest that of Nimar; the highest town ratio that of Bargarh in the Sambalpur district, and the lowest that of Chanda.

Berar.—In Berar, as is shown in the table on page 101, the mortality from small-pox in 1898 was less than in 1897 and still more below the mortality of the quinquennium as a whole. The months of March, April, and February had most deaths, and the months of September, October, and November fewest. As compared with the corresponding months of 1897, February, March, July, August, September, and October had more, and all the others fewer, deaths, the reduction being greatest in December. The highest rural district ratio was that of Buldana, and the lowest that of Amraoti; the highest town ratio that of Deulgaon Raja in the Buldana district, and the lowest that of Amraoti. In Berar, out of all the provinces, the proportion of children in the small-pox mortality was lowest.

Madras.—Madras in 1898 had a small-pox mortality which was below that of the preceding year, though higher than that of the quinquennium, as may be seen in the table on page 101. The number of deaths was much increased in January and February, increased in March and April, considerably reduced in May–November, and much reduced in December. The Sanitary Commissioner observes within the last three years a steady improvement in the rates within municipal towns as compared with their surrounding rural areas; and thinks this possibly due to the order that the chairman shall give a complete account of the methods of disposal of all births that have been registered, and have arrived at an age to receive vaccination. The highest rural district ratio was that of Ganjam, which was also the highest district ratio in India, and the highest town ratio that of Berhampur in the Ganjam district. The Sanitary Commissioner says :—

It will be noticed that the frightful rate of 12·2 per 1,000 registered against Ganjam during 1897 has undergone a decline; but that in 1898 the mortality from this cause was still of a most serious nature. It will be remembered that the impetus given to the disease during 1897 was due to famine conditions leading to the crowding of the people upon works. What with the existence of extensive hill tracts

inhabited by a class of people who probably would much prefer inoculation to vaccination, and the impossibility of dealing satisfactorily with any sanitary subject in zamindari tracts, Ganjam presents a most unpromising field to the sanitarian. Indeed, so little has it been considered possible to deal with the district by ordinary methods, that for the last ten years, in the hill tracts, the entire responsibility for the administration of the Vaccination Department has been in the hands of the civil authorities.

The Sanitary Commissioner also points out that in judging of the magnitude of small-pox epidemics, it is well to hold in mind that under the present system of registration in rural areas, and to a less extent in municipal towns, deaths from measles are apt to be included under " small-pox."

The lowest rural district ratio was that of Malabar, and the lowest town ratio that of Calicut, in Malabar.

Coorg.—Small-pox mortality in Coorg was reduced, and only 22 deaths in all were registered. These facts may be gathered from the table on page 101. The reduction took place in February, June, August, November; the numbers in other months rising or remaining unaltered. There was no urban mortality. The highest rural district ratio was that of Kiggatnad, and the lowest that of Naujarajapatna.

Bombay.—The small-pox statistics of Bombay will be found in the table on page 101. The mortality was half that of the preceding year and of the quinquennium. March, April, and February saw the greatest numbers of deaths, and October, November, and August, the smallest numbers. As compared with the corresponding months of 1897, the numbers were much reduced in March-June, August, and December; reduced in July, January, February, October, and November; and increased in September, The Sanitary Commissioner says:—

These figures may be considered very satisfactory, and they testify to the exceedingly good vaccination work which now for some years past has been done in the presidency. After the experience of the famine year of 1877 and the following year, when 27,369 and 4,475 deaths from small-pox were recorded, it is very satisfactory to be able to state that, notwithstanding much better registration, the famine year of 1897 and the following year gave only 3,835 and 1,834 deaths from the same disease. This result is chiefly to be attributed to the progress vaccination work has made since the former period.

The fact, however, seems to be that small-pox infection was not wide-spread in 1898, so that the state of vaccination was not really put to the proof. The highest rural district ratio was that of Khandesh. Barsi in the Sholapur district had the highest town ratio, and Surat the lowest.

Lower Burma.—The ratio of mortality from small-pox in Lower Burma was almost two and a half times greater than the corresponding ratio of 1897, and nearly as much greater than the quinquennial ratio. The table on page 101 gives the figures. The maximum numbers of deaths were in April, March, and May, and the minimum in November, October, and September. From January to July the increase was great over the corresponding months of 1897, but in the remaining months the increase became less marked. Excepting Mysore, Lower Burma had the highest rural and the highest urban mortality of any province. The highest rural district ratio was that of Tharrawaddy, and the lowest that of Akyab. The highest town mortality, which was also the highest in India, was that of Zigon, in the Pegu district, and the lowest that of Akyab.

Plague.

The Bacillus.—In the report for 1897 the point was noticed, references being given, that the descriptions of the bacillus given respectively by Kitasato and by Yersin, did not agree the one with the other. And Kitasato has lately again called attention to the discrepancy in the following words:—

It has been quite generally assumed that the bacillus above described [the one discovered by the author] is identical with that of Yersin, but this assumption is incorrect . . . . Further bacteriological investigations of the plague are desirable, and it is necessary that the scientific world should come to some definite conclusion as to the etiological bacilli before orrhotherapy and preventive inoculation can be instituted on a truly rational basis.

Balfour Stewart gives a good account of the methods of plague bacteriological diagnosis in use in the Bombay laboratory. He mentions that bacilli which have been cultivated for some time do not behave in quite the same way in culture media as bacilli fresh from a case of plague. Klein found that in the buried bodies of guinea-pigs the bacilli retained life and infectivity for 17 days, but that in 21 days or over they could no longer be cultivated or successfully inoculated.

Rats.—Experimenting with guinea pigs, rats, rabbits, and monkeys, Batzaroff found that a minute quantity of plague culture placed, even without producing excoriation, upon the nasal mucous membrane produced plague pneumonia ; and that the plague virus, dried with some albuminous matter, produced, when similarly inoculated, the same effect. Infection could also be brought about, but with gradually diminishing ease, through the conjunctival, buccal, intestinal, rectal, and vaginal mucous membranes.

Being requested by the Municipal Commissioner of Bombay to express his opinion on the importance of rats in the diffusion of the plague, Professor Lustig offered the following remarks :—

1st. I have performed experiments on hundreds of rats of different races, and living in the most different conditions, and I have found that almost all are able to get plague.

2nd. Keeping in a cage several infected and non-infected rats, all die in a short time, and in their bodies plague microbes are always to be found.

3rd. Mixing a virulent plague culture with the food given to some rats, all these generally died from plague, and it is quite common to find the bacilli in their fæces.

4th. Generally in the infected rats the microbes enter the blood, and with great facility they pass into the urine. Thus this urine becomes a very infectant liquid.

5th. In 1897 I had occasion to examine at Poona some dead rats found in a granary, and in these I found plenty of microbes. I investigated also the corn of this granary, but I did not discover any plague microbes in it. Nevertheless, I know that two cooks who ate of this corn died from plague a few days after.

6th. I believe that the rats represent one of the most important means of diffusion of the disease, because they are able to carry everywhere virulent microbes.

The destruction of the rats is one of the most important measures to be taken against the plague. For this purpose poisons can be very useful, and specially would it be useful to provoke amongst the rats another epidemic with a microbe not virulent to man. For this purpose I believe that Loeffler's microbe would be the best, because it was used with satisfactory results in Thessaly some years ago. I got a culture of this microbe and tried it on white mice, and obtained a culture which was very virulent, but I had not success with the black rats. I know that the same was experienced by Dr. Galleotti, to whom I sent one of my cultures of Lœffler's microbe. Dr. Galleotti will receive in a short time from Prague another more virulent culture of the same microbe, and will repeat the experiments.

Manson also strongly believes that plague is a rat-borne disease, and that the most important *prophylactic* measure against plague is the destruction of rats ; and it has been asserted by another writer that one reason of Calcutta's relative immunity is the comparative scarcity of rats. The official plague reports of Calcutta, however, show no knowledge of any such scarcity : in fact rats are frequently mentioned. On the other hand, the following has been put forward as the conclusion to be derived from the evidence offered to the British Plague Commission :—

It seems, then, that while rats suffer from plague, and the death of unusually large numbers of these animals is an important sign of a place having become infected with this disease—all the more important as it may occur very early, before the few cases that have occurred have attracted the attention of the authorities—yet they do not play an important part in the actual spread of the disease, which may be very severe without any marked increased mortality among these rodents.

Meanwhile, it is safest that action should be inspired by the opinion that rats constitute a great danger.

Insects.—Nuttall, who had previously contributed much to knowledge of the subject, read before the British Medical Association an important paper on the subject of the part played by insects in the propagation of infective diseases. With regard to plague he says :—

An active part has recently been attributed by clinical writers to blood-sucking insects in plague. Bugs and fleas were supposed to be the active agents here. Experiments made by the writer on animals with plague, anthrax, mouse septicaemia, and chicken cholera, all gave negative results. In a large number of experiments made by allowing these insects to bite animals dying of the diseases named, and then immediately afterwards transferring them to healthy animals, not a single case of infection occurred. Though the dejecta of bugs contained virulent bacilli after twenty-four hours, they did not do so later. In fact, it was shown that both fleas and bugs digest various pathogenic bacteria which they have taken up with the blood of diseased animals. Simond (1898) goes so far in his elaborate theorising as to conclude that plague bacilli may acquire a heightened virulence in the bodies of such insects. He attributes a very important share to these insects in the propagation of plague, but gives no evidence to prove his assertions. The entirely negative results of my experiments should weigh more than gratuitous assumptions. That a bug or flea filled with the blood of a patient containing plague bacilli may serve as a passive carrier of the germs may be safely concluded from my experiments with these and other germs which were seen to remain alive and virulent in the bodies of these insects for twenty-four hours or longer when they were kept at low temperatures. If such an insect were crushed and the skin scratched by nails soiled with the blood it contained, infection might readily occur. In warm weather the insects are physiologically more alive, and consequently digest the micro-organisms more rapidly.

In another paper Nuttall, after mentioning that Simond had shown experimentally that rat-fleas, if placed upon them, will attack men and dogs, goes on to say that it appears to be unknown to Simond that the rat-flea belongs to a different family from the *pulex irritans*, and that it has yet to be proved that it will attack men under natural circumstances,* whatever may be the case in laboratory experiments. Mühling also from experiments with anthrax bacilli came to the conclusion that any danger there might be was not from the insect biting the man but from the man crushing the insect and scratching it into his skin.

Dust.—Neisser's experimental results support the opinion of Germano that there is no danger of the conveyance of plague by the dust floating in the air of rooms. The subject of the aërial conveyance of the disease is mentioned again in the abstract of the report of the German Plague Commission.

Infectiveness in convalescence.—It has been stated that plague bacilli have been found in the throat several days after the temperature had returned to normal.

Susceptible articles.—Kurth, of the Bremen Bacteriological Institute, after an examination of suspected jute, cotton, and hides, reported that he could find no evidence of the importation or of the likelihood of importation thereby of plague bacilli. It will be seen in a subsequent paragraph that the German Plague Commission formed the same opinion as regards hides.

Favouring conditions, mixed infections, natural course.—It has suggested itself to some minds that the outbreak of an epidemic is not due to the arrival of the bacillus, but to some change in the inhabitants or their environment; and it has even been hinted that in the intervals between epidemics the bacillus may lead a saprophytic existence, waiting for the return of conditions favourable to parasitism. If such be the case, the conditions must be such as affect men and rats simultaneously. An interesting and striking paper on the meteorological relations of plague, especially on its relation to vapour tension, is described as having been quite recently read by Mr. Baldwin Latham before the Royal Meteorological Society. The influence of vaccination against small-pox in strengthening resisting power against plague has also been discussed. Such vaccination has probably no effect. Pearse in a letter to the *Lancet* gives a list of the infective diseases from which Bombay patients have been found to be suffering along with plague. Some disease-viruses appeared to assist that of plague more than others did. Again, it has been stated that the mortality curves for the large cities of Poona, Bombay, and Calcutta for plague epidemics show great similarity; and that this points to the existence of a natural course and limit for a plague epidemic, a fact which must be taken into account in estimating the effect of measures adopted to arrest the progress of the outbreak.

Incubation, case-mortality, diagnosis.—Haffkine considers that the period of incubation is on the average five days, but may extend to 10. The case-mortality appears to vary between 50 and 90 per cent.; Müller puts it at 62, and Pearse at 75 or more. In practice a diagnosis has sometimes had to be made between influenzal pneumonia and plague pneumonia.

Inoculation.—The case for prophylactic inoculation has been clearly stated by Haffkine in a lecture before the Royal Society.

Mahamari.—With regard to Mahamari, Captain Leonard Rogers, I.M.S., records the following interesting remarks:—

> From inquiries that I have recently made in the Kumaon hills it appears that the term Mahamari is applied in these parts to any epidemic disease which is attended by a very high mortality, and under this name I have had a typical outbreak of cholera described to me by villagers. On the other hand, any infectious disease which is attended by a comparatively low mortality is called Sunjar, which term would probably include such diseases as measles and chicken-pox, &c., if they occur in these parts. From an examination of the records it appears to be certain that some of the outbreaks of so-called Mahamari are exactly similar to true plague, notably those of 1853–4, which spread down

* Sambon in J. T. M. of December 1899, page 119, agrees with Simond; but Galli-Valerio in C. B. XXVII., page 1, proves Simond to be probably wrong and certainly premature.

to the districts of Bijnor and Moradabad, and of 1876–7. It is, however, equally certain that this form of the disease may be absent from the hills for several years at a time, as for instance, between the years 1878 and 1881, when, although the whole of the villages of Kumaon and Garhwal were carefully inspected yearly and a special report made, no cases of the disease were found. Further, it seems likely from the descriptions that some of the outbreaks that have been returned as Mahamari have been outbreaks of typhus fever and not of plague, and that the latter are comparatively rare. Again, the outbreaks of the plague-like disease nearly always begin in the higher parts of the district, which border on Tibet, and it seems very probable that they originate in that country which, together with Yunnan, appears to be the home of the plague, from whence it spread to Canton and Hong Kong in 1893; and that it is more likely that the plague reached Bombay in that roundabout way than that it travelled direct from Garhwal to the western part of India.

German Plague Commission.—In the report for 1897 use was made of preliminary papers published by members of the German Plague Commission. Their official report is now published, and the following is a brief summary of some of the chief points :—

The question as to where the Bombay plague came from cannot be definitely settled; but the probability is that it came from the Mahamari region in Northern India, just as the plague of Canton in 1894 came from the endemic tract in Yunnan. Rats certainly played a part in the spread of the disease, but not mice. Whether the plague passes from rats to man by means of the excretions of the sick and dead animals or by means of insects, there can be no doubt of the danger of infected rats for man; but at the same time it is clear that under favourable circumstances plague can flourish without the help of rats. Though the evidence is not complete, it seems probable that insects do not play an important part in the conveyance of the disease. If they ever do, it is most likely to be in the overcrowded dwellings of the poor, where also the sputum of pneumonia cases is frequently received on the hands or clothes of the relatives of the sick. As the hospital staffs were hardly attacked, it seems pretty certain that mosquitoes at any rate were not concerned. The clinical forms are the Bubonic, the Pustular, and the Pulmonary. There is probably no *primary* plague septicæmia; and no cases of intestinal plague were met with. The presence of the bacillus in the blood is an *almost* certain precursor of death. The hæmorrhages so frequent in plague are not due to the bacilli directly but to the toxin, as is shown by the fact that fœtuses born of plague mothers, but themselves free from the bacillus, show them. In bubonic cases the bacillus is found in the buboes, and especially in the inflamed connective tissue surrounding the buboes; in pneumonic cases, in the lungs; in septicæmic cases in the blood, spleen, secondarily affected lymph glands, bone marrow, bile, often also in the urine, peritoneal fluid, juice of hypostatically congested lungs, fluid of plague meningitis, sometimes in the blood and milk of women in labour. The bacillus was found in the sputum of pneumonic cases, in the bronchitic sputum of septicæmic cases, and sometimes in the urine, but not in the skin-petechiæ, the saliva, the fæces, the sweat, nor in the milk* and lochia of plague-stricken women. Buboes that have undergone puriform liquefaction are sterile, but when true pus appears, it contains staphylococci and streptecocci, and occasionally plague bacilli if it has not become sterile. In the lungs the *bacillus pestis* is found alone or with the diplococcus, or the streptococcus, or the influenza bacillus, or the tubercle bacillus. These seem to prepare a favourable ground for the plague bacillus; and when a tuberculous man recovers from plague, his tubercular affection becomes rapidly worse. When a skin lesion is found, it is not always on the extremities, but sometimes on such out-of-the-way places as the navel, the buttocks, or the foreskin. From the habit children have of putting everything in their mouths, they are apt to have submaxillary buboes. The end of the third day is the normal end of the disease; all continuations are relapses of three days' duration each, or are due to complications and sequelae.

The *bacillus pestis* possesses a capsule. It is non-motile, and has no flagella. It cannot be stained by Gram's method. It does not form spores. Well-marked involution forms appear in cultivations, especially in agar containing salt, and in corpses. It flourishes well between 30° and 37° C., not showing any evident optimum, but it seems as if a temperature somewhat below 20° were better for it than body temperature. At temperatures below 20° its growth is proportionately delayed. But at all temperatures its growth is markedly slow. It is strictly aërobic, and grows best in slightly alkaline media, requiring, however, a pretty high degree of concentration in its food. Pure cultures protected from drying and from light retain their vitality for months. The bacilli cannot stand quick and energetic drying. Apparently quick drying at a high temperature is more speedily fatal to them than slow drying at a low temperature. It is, therefore, not likely that in hot countries they can be carried in dust. Exposed to the sun, a thin layer dies more quickly than a thick one; but keeping the layer cool with water preserves its vitality. A layer on wool remains longer pathogenic than one on silk. Moist heat at 55°, 60°, or 70° C. killed the bacilli in 10 minutes, at 80° in 5 minutes, and at 100° at once. In the laboratory the best disinfectants were found to be steam, carbolic acid, lysol, corrosive sublimate, chloride of lime, milk of lime. In pneumonic sputum preserved for 16 days there were no longer any virulent bacilli, though there had been on the 10th day. In ordinary pipe water the bacilli were no longer virulent after five days, and in sterile water after ten days. In sterilized fæces and urine they did not live longer than five days. All the experiments show that the *bacillus pestis* possesses little resisting power, and it does not appear likely that it produces a resting form.

Rodents possess less resisting power against the plague bacillus than other animals, and the rat the least of all. But the grey monkey (*semnopithecus entellus*) is nearly as sensitive. On the other hand, horses, cattle, sheep, and goats fall sick when inoculated with large doses, but practically always recover; so that they are not likely to acquire the disease naturally, and their hides are not likely to

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* There seems some discrepancy between the statements about the presence or absence of the bacillus in the milk of women, on pages 79 and 273 of the German Report.

be dangerous. Bodies of cats were sometimes brought in, but the animals seemed to have really died of starvation ;* and cats soon recovered when inoculated. Dogs are not susceptible, or very little ; pigs are almost completely insusceptible ; birds are insusceptible.

Plague is, like anthrax, rather infective than toxic, but the toxin counts for something in human plague. Experiments on animals show that the toxic action is not very great, not nearly so great as in enteric fever and cholera, not to mention diphtheria. Man seems to be comparatively tolerant of the poison ; but a man who has recovered from plague reacts more strongly than a healthy man to an injection of dead bacilli. The agglutinating action of plague serum is not of absolute value : a negative result cannot be used against the diagnosis "plague," but a positive reaction is a very valuable criterion of plague having been passed through. Again, plague serum is an excellent means for the differential diagnosis of true plague bacilli from those resembling them. As with cholera and enteric fever, the agglutinating action of the serum is in no way parallel to its protective and immunizing effects.

Experiments on animals gave hope for the success of preventive inoculation, and the results in man, so far as they went, were also favourable, but only experience can finally decide. With regard to the therapeutic use of serum, the only certain conclusion so far is that it does not produce directly or indirectly any visible harmful effects.

In a lecture before the German Public Health Society, R. Pfeiffer, of the German Plague Commission, gave a short and clear account of the results of the labours of the Commission.

Müller, of the Austrian Plague Commission, did not find any evidence of the agency of insects in the conveyance of infection. The bacteriological part of the Austrian report does not seem to have been published yet, only the clinical part being available.

The Plague Commission appointed by the Right Honourable the Secretary of State arrived in India in November and left in March, 1899. The report has not yet been published.

Other Reports.—Yersin, who shares Simond's views as to the large part taken by insects in the propagation of the disease, has published a report on the plague at Nhatrang in Annam. Total evacuation of the infected village, transfer of the inhabitants to a temporary village on a new site, destruction of the infected houses and those immediately surrounding them by fire, were the principal effective measures. A report by Dr. Gomes da Silva regarding the plague at Macao and Lappa in 1897 has also appeared. Finally, Dr. Favre has written on an as yet not completely investigated "plague-like" disease which attracted attention in the years 1888—94 in a remote corner of Siberia, which is said to be spread by a species of rodent, a marmot, and which the people are said to combat by evacuation, isolation, and fire.

Conclusions.—No new fact of importance regarding plague has been discovered since paragraph 176 of the report for 1897 was written (page 119 of Parliamentary Report, C. 9549). While rats have continued to maintain their importance, no fresh evidence has been obtained in favour of the alleged active rôle of insects in the propagation of the disease. The point raised by Kitasato, as quoted on page 103, is one that should be settled.

Plague in 1898.—The conclusions as to the method of progress of the disease and as to the measures adopted by the authorities must be much the same as those given in paragraph 187 (page 126 of Parliamentary Report, C. 9549), and paragraph 206 (page 135 of Parliamentary Report, C. 9549) of the report for 1897. The only change in measures, besides the improvement due to experience, was in the direction of mildening and popularizing them : not because the rules, which were scientifically stringent, were in themselves undesirable, but because it was found impracticable to carry them out in all their fulness, at least in the large towns. Endeavours were made, in various ways, to reconcile the people to the measures taken for their benefit, and to enlist the help of respectable and intelligent members of the native community. Where these were successful, the result, on the whole, was that, while certain desirable benefits had to be sacrificed, the detection of cases, the very basis of all possible measures, was facilitated.

Plague appeared indigenously for the first time in Bengal, Rajputana, the Central Provinces, Mysore, and Madras, but did not recur in Central India or Garhwal. The following tables show the statistics of the Indian plague of 1898, so far as they have been

* But see Lorans in B. M. J., 2nd December, 1899, page 1588.

received in this office ; but both the figures and the list of localities are certainly very incomplete :—

Statement showing the deaths from Plague in the different Provinces by Months during the year 1898.

PROVINCES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL. 1898.	TOTAL. 1897.
Bengal	—	—	1	28	31	58	41	26	23	3	5	3	219	—
North-Western Provinces and Oudh.	17	30	71	27	2	—	—	—	—	—	—	1	148	72
Punjab	23	222	654	610	481	18	1	—	—	—	3	7	2,019	179
Central Provinces ...	—	—	—	—	—	—	—	—	—	1	33	97	131	11
Hyderabad State ...	478	545	132	6	2	—	7	—	155	571	1,288	684	3,868	8
Madras Presidency ...	—	—	—	—	—	—	—	13	26	80	133	305	557	2
Bombay ,, ...	6,203	6,811	6,651	3,773	2,759	1,003	2,490	6,515	10,952	17,227	13,777	8,030	86,191	47,710
Rajputana	71	35	10	5	—	—	—	—	—	1	1	1	124	44
Mysore	—	—	—	—	—	—	—	15	151	1,270	1,547	2,352	5,335	—
Baluchistan	—	—	—	3	15	—	—	—	—	—	—	—	18*	1
Central India	—	—	—	—	1	—	—	—	—	—	2	—	3	63†
Garhwal	—	—	—	—	—	—	—	—	—	—	—	—	—	17
Cutch	—	—	—	—	—	—	—	—	—	—	—	—	—	5,709
TOTAL ...	6,792	7,643	7,519	4,452	3,291	1,079	2,539	6,569	11,307	19,153	16,789	11,480	98,613	53,816

* Imported cases. † Including 52 at Khandaoni.

Deaths from Plague in native states of the Bombay Presidency from 1*st January to* 30*th December*, 1898.

Native States.	Deaths from Plague.
Baroda	3,705
Kathiawar	1,506
Cutch	1,399
Kolhapur and Southern Maratha Country ...	9,441
*Rewa Kantha	160
Bhor	753
Palanpur	391
Savantvadi	9
*Dharmpur	43
Janjira, ...	21
Akalkot	236
*Savanur	8
TOTAL	17,672

For Aundh and Sachin the figures of 1898 cannot be given separately. From September, 1896, to 30th December, 1898, they had, respectively, 1,216 and 275 deaths.
* These had no plague in 1897.

Part of the increase was no doubt due to the greater success attained in the detection and registration of cases: but the tables show that the disease both extended its boundaries and attacked more men in 1898.

On the 10th January, 1898, the Bombay Government issued instructions regarding plague administration for the general guidance of district and other officers. A copy of these instructions is printed as an appendix to this section.* In their resolution of the 3rd February, 1898, the Government of India expressed general approval of these rules, at the same time laying down their views on certain points of plague administration. These points were :—general organization for the detection of cases ; the unpopularity, and consequent ineffectiveness of corpse-inspection ; the division of towns into wards of manageable size, each under a European officer of influence aided by respectable natives of standing, and by female medical attendants for the inspection of women ; the necessity

* Not reprinted.

that segregation should be carried out in hospitals or other suitable places specially appointed for the purpose ; the good to be obtained by carefully explaining to the people the reasons for the measures, by getting the co-operation of leading native men, by paying due regard to the feelings and habits of the people, by encouraging the people to make segregation arrangements for themselves, and by refraining from separating the members of families ; the need for encouraging inoculation, while keeping it strictly voluntary ; the importance of making efficient arrangements to prevent people from returning to occupy evacuated houses before the time specified, and of securing that all articles likely to convey infection are without exception removed from infected houses and immediately destroyed or disinfected ; the reasons why the Government disapproves of sea or land quarantine ; the reason why the Government disapproves, as a rule, of the use of cordons ; in completion of the terms of the Venice Convention, approval of railway medical inspection being conducted so as to provide for the detention in the observation camp not only of persons in whom symptoms of plague or suspicious symptoms are discovered, but of all persons from the infected area who appear to be suspicious by reason of their appearance, the dirty condition of their clothes, the fact that they are travelling in gangs, or belong to classes which are likely to disseminate the disease or to be untraceable on arrival at their destination or which cannot be depended upon to give information should plague occur among them after arrival at their destination, all other persons being allowed to proceed to their destination after inspection, and the rules not being allowed to exempt any class of persons as such or any railway class ; finally, arrangements for checking the danger caused by pilgrimages.

Plague in the Bombay Presidency.—At the end of 1896 there had been a total of 2,909 attacks and 2,086 deaths from plague ; 61,093 attacks and 46,944 deaths were recorded during 1897 ; while 1898 saw 110,369 attacks and 86,191 deaths. The number of towns and villages affected was 1,188 against 912 in 1897. The deaths from plague in 1897 had been nearly exactly the same in number as the cholera deaths during the worst cholera year in the previous nineteen years. The heaviest mortality from cholera during the last twenty years occurred in the year 1897, but the plague deaths in 1898 exceeded this by 29,082. The parts most affected were the collectorates of Dharwar, City of Bombay, and Belgam, and the rates of plague deaths in them were 26·4, 22·4, and 16·1, respectively. Satara came next with a rate of 5·6, and then Kurrachee, Thana, Surat, Nasik, and Sholapur (2·08), the rates of the remaining affected collectorates being much lower. The only parts of Sind which returned indigenous cases were the towns of Kurrachee and Kotri, the former suffering severely. Except for a few imported cases, the collectorate of Ahmedabad was entirely free. With the foregoing exceptions, all the collectorates in the Presidency were more or less affected.

Recognizing that the plague had come to stay, and that it was impracticable over a large area and a prolonged period of time to close the ordinary channels of daily business and intercourse without very sorely trying the patience of the public and jeopardizing general prosperity, the Government of Bombay by their Resolution of the 17th October, 1898, made certain changes in the method of dealing under the Epidemic Diseases Act with travellers by railway. Railway detention camps and passes were discontinued, and replaced by a very strict medical examination, accompanied by disinfection of clothing, where necessary, at convenient railway centres and at places of arrival. Persons coming from infected localities were ordered to be subject to surveillance for ten days after arrival. It was ordered that at each examining station the examination should be conducted in the same way as for passengers departing by sea from Bombay. The detailed orders as to examination, disinfection, and surveillance were so worded as to endeavour to secure the maximum preventive efficiency with the minimum of inconvenience to travellers. Persons travelling with certificates of inoculation, provided the date of such inoculation was certified to be within the last six months but not within the ten days immediately preceding, and provided the identity of the holders was not open to doubt, were ordinarily to be allowed to pass with the examination prescribed for first and second class passengers, except that they would probably be required to detrain. Discretion was left to local authorities to issue such orders as might be necessary, consistent with the general instructions and declared policy of government, as to special regulations for travellers who could not be depended upon to give a trustworthy account of their residence and movements or were suspicious whether by reason of their appearance or symptoms or the dirty condition of their clothes or effects. But in the orders regarding the surveillance of new arrivals it was emphatically laid down that under no circumstances would any respectable healthy person who could give a reference either in the place he came from or in the place at which he had arrived be detained.

Plague in Bombay City.—Full details regarding the disease and the measures adopted against it are given in the report of the Municipal Commissioner.

The second part of his Report is devoted to the subject of hospitals, public and private, to the consideration by the medical officers of plague as a disease, and to the results of the use of various sera.

It was, in fact, found impossible in the city of Bombay to detect all cases of plague either before or after the outbreak had attained epidemic proportions ; and the number of plague deaths escaping discovery increased with the severity of the epidemic to such an extent that when plague was at its worst it was not certain that much more than half the plague deaths had been correctly ascertained. Also, when plague cases were discovered, their discovery was in many cases too late to prevent the escape of those who ought to have been segregrated or placed under surveillance. It was found, too, that specially stringent measures for the discovery of cases led to organized and extensive concealment. The general conclusion arrived at by the local government was that the efficiency of the measures approved by the Government of India in their Resolution of the 3rd of February, 1898, depends mainly on the exhaustive discovery of plague cases. Where cases remain undiscovered, measures, however well devised, must fail ; for undiscovered sources of infection, both personal and local, remain. The system which will result in leaving fewest cases undiscovered will be the most effective ; and experience in the city of Bombay has indicated as best that particular system which causes the least amount of popular resistance and discontent, while securing a treatment of infected persons and places such as to prevent any serious danger from them after they have been discovered.

Plague in the Port of Bombay.—During the year 71,498 vessels of all sorts with 1,207,571 crew and passengers were examined. The number includes every person who left Bombay by sea during the year, as well as those who arrived from the ports of Western India between Kurrachee and Bhatkal, inclusive, between the dates of 1st January and 20th April. After the latter date, and up to the end of the year, arrivals from infected ports only were subjected to a medical examination. The total number of plague cases detected during the year was 118. On vessels and native craft in the harbour 17 cases were found. Besides these, 96 cases were prevented from sailing on vessels leaving the port, and five were discovered on vessels coming from infected ports close to Bombay. A special sanitary police force was found necessary to assist the port health staff in carrying out the provisions of the Venice Convention. Government, therefore, sanctioned 12 European and 50 native police for such work, and placed them under the orders of the Port Health Officer. Owing to the marked recrudescence of the plague in January, an exodus set in, and 30,878 more people left Bombay by sea than arrived during that month. They where chiefly millhands and labourers who had their homes along the coast in close proximity to Bombay. In order to prevent the spread of plague to the coast ports, Government directed that in addition to the inspection before leaving Bombay, the people were to be inspected a second time at the port of arrival. Native craft were prohibited from taking passengers, so that the inspections at the coast ports could be carried out at the places where the steamers called. Afterwards, owing to the diminution of plague along the coast ports near Bombay, inward sea inspections from such places were suspended on the 20th April, and only vessels coming from infected ports were examined. When the third marked epidemic of plague in Bombay commenced towards the end of the year, arrangements were made with the Peninsular and Oriental Company for the disinfection of all clothing and bedding of the native crews prior to sailing. This disinfection has now been extended to the clothing and bedding of all native crews bound to any port out of India, aud is said to be working satisfactorily. Since the 1st September the inspection of the crews and passengers of outward-bound vessels which sailed to ports other than Indian ports has been made on shore prior to their embarkation, as directed by the Venice Sanitary Convention. The ship's company was again inspected on board before the issue of a Bill of Health immediately before departure from Bombay. The Bill of Health form was also revised accordingly. Experience has shown that a slight rise of body temperature proceeds the more definite signs of plague ; and, notwithstanding the difficulties due to the prejudices and carelessness of the people, the clinical thermometer was diligently used. In some cases it was found that passengers suffering from a rise of temperature had tried to reduce it immediately before examination by wetting their bodies with water, sucking ice, or taking doses of phenacetine. The newspapers reported cases of plague from Bombay at foreign ports from time to time ;

but subsequent inquiry in almost all cases proved they were not cases of plague, as in instances which occurred at Suez and Colombo. As far as is known at Bombay, also, plague broke out at Tamatave, Madagascar, in November and December, 1898, that is fifteen months after the last steamer left Bombay for Madagascar.

Plague in Bengal.—The plague deaths shown opposite Bengal in the table on page 108 belong, with the exception of 16, to the city of Calcutta. The alleged occurrence of plague in Calcutta in 1896 was discussed in the report for that year. On the 15th of April, 1898, the Health Officer was informed of the finding of dead rats, and on the 17th he saw the first human case brought to his notice. Though this was not really the first case that had occurred, he believed it to be a very early one, because noticeable rat mortality was of only quite recent occurrence. The diagnosis in this case was bacteriologically confirmed by Mr. Haffkine. One of the domes who assisted at the *post-mortem* examination, and who had then scratched himself on a point of bone, became ill with fever two days after, and died in fourteen days from what was believed to be plague. Four other domes contracted the disease in a similar manner. As usual, at the beginning of the outbreak there was a number of cases which were difficult to diagnose; and there were at first, and even afterwards, many persons who disbelieved in the reality of the visitation. Another ground of disbelief was the slowness of its spread, the absence of manifest epidemicity, and the low general mortality of the city; but the high case-mortality, the clinical symptoms, the pathological appearances, and above all the repeated positive results obtained by competent bacteriologists, stamped the disease as true plague. Most of the cases occurred in the middle of the town; the north, south, and east being practically free. Very little evidence could be obtained as to the manner in which the infection was carried from place to place or from person to person, partly on account of the difficulty of getting an accurate history. In the case of a European who lived in airy rooms on the roof of a lofty building, information was given that his pet dog brought a dead rat, and deposited it in his bed. At one time dead rats began to be noticed in considerable numbers in the General Market, in the neighbourhood of which human cases had been occurring, and were found on investigation to have died of plague. The entire market was very thoroughly disinfected, coolies being put on and working in shifts night and day. In this area human cases were discovered before rodent, but the Health Officer thinks from the way the disease appeared amongst different classes all round this quarter and the suddenness of the onset, that it is much more probable that infection of rats came first, though it was not discovered till after several cases had occurred. The network of sewers and the fact that the rats of one area can infect the rats of another area, even if they do not travel long distances themselves, render infection easy. Whether the disease is conveyed from infected rats to human beings by the germs incubating in the floors and ground, or through the agency of vermin on the rats, the Health Officer has no evidence to offer. In some houses the death of rats was not followed by plague, although plague cases always took place in the vicinity. The aims of the measures adopted were, as usual, detection of cases, segregation of sick and "contacts," evacuation of infected houses and localities, disinfection of infected houses and localities, and the improvement of general sanitation. But, to allay the alarm of the people, who were already beginning to leave Calcutta in large numbers, the following announcements were made :—

> Quarantine will not be enforced by Government against Calcutta.
>
> No segregation will be enforced if the entire household has been inoculated.
>
> No one will be declared plague-stricken without being seen by a competent medical officer, male or female, deputed by the municipality.
>
> No one will be separated from his or her family. If necessary, all will go together to a camp, where the *purdah* will be respected.
>
> Compensation will be paid on the spot, if any property is destroyed in being disinfected.
>
> Encouragement will be given to the public to provide private family hospitals for the treatment of their relatives in their private houses, where proper accommodation is obtainable.
>
> No person will be removed except on the order of a medical officer. The police are not authorised to examine or remove any one.

The period following the announcement of plague was characterised by organization on the part of the authorities; by panics, strikes, and disturbances amongst the lower classes of the people. In the districts and wards, committees were formed, whose duties were to make house-to-house inquiries as to the health of the people and report suspicious cases;

to establish ward and caste hospitals, and to report any serious sanitary defects. These committees mostly worked well, but they failed to gain the confidence of the people, who concealed cases from them almost as much as they did from the executive. As they had no power of entry, they could only accept what they were told. So the net result of their arduous and disinterested labours was somewhat disappointing, so far as the detection of cases was concerned. In fact, the greatest difficulty in dealing with the plague was the distrust and suspicion with which all plague officers were treated. Some inoculation was done, but its progress was stayed by the angry excitement caused by the circulation of wild stories prompted by malice or ignorance. Ultimately, owing to the small amount of plague, the absence of scare, and the removal of the office from the Health Office to the Town Hall, the number of people seeking inoculation decreased rapidly, until only those who desired to travel by rail, under the Government Notification of 30th October, 1898, without the inconvenience of detention at the inspection camps, came for inoculation. On the 10th of October, Calcutta was declared free from plague under the terms of the Venice Convention. The Special Health Officer remarked that the course of the plague in Calcutta was anomalous, and that, although isolation, as well as vacation of affected spots, had been thoroughly carried out, it was too much to hope that its diminution was due to those measures only, in view of their reported failure in preventing the spread of plague elsewhere. He was convinced that sporadic cases were still occurring, and that the up-keep of the organization for dealing with the disease was justified. Though such cases were few, inquiry was rendered difficult by fictitious addresses being given at the burning ghât, by lying statements being made by the occupiers of houses where deaths had occurred, and by false statements being furnished by the *kavirajes* and practitioners attending the cases. The lapse of time, unfortunately, demonstrated the correctness of the Special Health Officer's opinion, as ten more deaths occurred before the end of the year, in four of which bacteriological examination was used to support the diagnosis. At this time the cases were occurring chiefly amongst the Marwari community. There was great dread of Calcutta being again declared infected, and cases were systematically concealed. It was not, however, till February, 1899, that the increasing number of cases caused Government to re-impose the rules.

Besides the deaths in Calcutta, five occurred at Chausa (Railway Inspection Station), one in March, one in June, two in July, and one in August; and eleven in villages in the Backergunge district. Seven of the deaths in Calcutta, two of those at Chausa, and all the eleven in Backergunge were in direct connection with cases that had occurred in a house in Calcutta. Two of the remaining Chausa deaths were also due to Calcutta, and the fifth was that of a man who had come from Jullundur. The affected locality in Backergunge consisted of the two adjacent villages of Siddhakati and Abhoynil, about three miles south of Nalchiti, a small trading town with a municipality and a steamer station. The affected villages consisted of a number of scattered homesteads, each of which is well separated from its neighbour. The inhabitants, with few exceptions, showed a very reasonable spirit, and helped in the evacuation and burning down of the infected huts, and in the segregation of the sick and their families. For the houses burnt full compensation was paid.

The four plague observation camps at Chausa, Chakradharpore, Mairwa, and Khurda Road, which were established along the western frontier of Bengal to guard against the importation of plague into it by railway passengers from Bombay and other affected places, were in full working order throughout 1898, the second and third having been opened on 22nd February and 19th January respectively. The examinatian of passengers was conducted in the same way as in 1897. At the Chausa camp, which was the most important of all, the total number of persons inspected and detained amounted to 636,819 and 24,776 respectively. Among those detained at Chausa there were only 18 deaths, five of which, as already stated, were from plague (four bubonic and one pneumonic). There were no plague deaths in the other camps.

No Jeddah pilgrim vessel left Calcutta, nor did any arrive, during the year. The embarkation of pilgrims took place from Chittagong. Two hundred and twenty-seven vessels arrived during the year from the plague-infected ports of Bombay, Kurrachee, Hong Kong, and the Hedjaz. No case of plague was found on any of these vessels; but one of them, from Hong Kong, had had a case of plague removed from her at Penang. One case was found in connection with the shipping in the person of a customs officer; but after his death the attempt to cultivate the plague bacillus from his organs failed. The vessel was disinfected.

Plague in the Punjab.—For the Punjab the plague statistics are given in the table on page 108, as well as in the following :—

Months.	Jullundur.		Hoshiarpur.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
January	19	11	17	12	36	23
February	211	191	72	31	283	222
March	869	564	132	90	1,001	654
April	861	491	203	119	1,064	610
May	452	355	235	126	687	481
June	15	10	16	8	31	18
July	5	1	—	—	5	1
August	2	—	1	—	3	—
September	—	—	—	—	—	—
October	6	—	1	—	7	—
November	7	3	—	—	7	3
December	11	7	—	—	11	7
Total	2,458	1,633	677	386	3,135	2,019

During January no fresh infected villages were discovered, but in February 15 were found. In March, in which month 27 more villages became infected, a system of rewards for early information regarding newly attacked villages came fully into force, and is said to have probably had better results than any other system. The heavy punishment meted out to some lumbardars for concealing the existence of the disease in their villages had also a very salutary effect. During April 34 new villages were attacked, but in May only eight, and after July no new village was attacked until the fourth quarter of the year. During June occurred two or three isolated cases of what seemed to be a mild form of plague. In no case was the patient very ill, nor did the infection spread to other members of the family. This, it is considered, probably indicates that the disease had taken on the mild form noticed by others at the beginning or at the end of epidemics. Such cases require special information, as, if not promptly recognised and treated, they may be the means of keeping plague extant in a district from one cold weather to the next. In paragraphs 182, 196, 197, and pages 193 and 205 of the report for 1897 are mentioned the chief conclusions formed as to the mode of spread of plague in the Punjab, and specimens of the measures adopted. A cordon was drawn round the affected village ; a nominal roll of those within the cordon was taken ; the village was totally evacuated ; the inhabitants were removed to "healthy" and segregation camps, the latter with its inmates and their belongings being subjected to disinfection ; the village was thoroughly disinfected ; and the inhabitants were not allowed to return to their disinfected village till three weeks in summer, or one month in winter, had elapsed since the occurrence of a case in camp. It was noticed that plague re-introduced into a disinfected village showed little or no tendency to spread, and might usually be checked by the evacuation of one or two houses. With regard to the efficacy of evacuation the Deputy Sanitary Commissioner, Captain James, I. M. S., says :—

> It is therefore fairly well established that in evacuation we have a method of quickly and certainly stamping out plague. In not a single village in the areas under consideration can it be said to have failed. It was successful in every season of the year, though it took longer in the winter than in the summer. It was equally successful in large villages of from 3,000 to 6,000 people as in little hamlets.

The disease usually declared itself within five days after exposure to infection. With regard to Haffkine's system of preventive inoculation the summing-up given is as follows :—

> It is only when the prophylactic has been tried in a large number of cases all over the country and under varying conditions that a definite decision as to its efficacy in protecting against plague will be arrived at. It will never be the sole remedy against the progress of the malady, but it may possibly become one of the chief measures. Small-pox is not nearly so infectious as this disease, and yet we have a more perfect protective serum to combat it, namely, vaccine lymph. This remedy has now been tried for a hundred years, and tried on a very extensive scale. It has considerably diminished the amount of small-pox in existence, but it has not banished it. In the same way, it is impossible to believe that any form of protective inoculation can ever be effective if used as the only means of preventing infection. It is extremely difficult to inoculate large communities, and a few will always

escape, and those few have the power of keeping the disease in existence, ready to break out again when favourable conditions arise ; if, on the other hand, we look upon the inoculation as one, but only one, of the excellent sanitary measures which science has given us to combat this malady, then there is every hope of its becoming a powerful weapon in our hands.

Plague in the North-Western Provinces and Oudh.—The plague statistics of the North-Western Provinces and Oudh for 1898 are shown in the table on page 108. There were 191 seizures with 148 deaths against 97 and 72 in 1897. The disease remained confined to the Saharanpur district. The first case occurred in Jawalapur on the 9th January. The actual mode of introduction is unknown ; but as this town is only a short distance from some of the infected areas, the attack was confidently anticipated by the Sanitary Commissioner. The disease rapidly spread, and, as in Kankhal, cannot be said to have been arrested until the entire town had been evacuated. Cases continued to occur in the camps until the 28th May. The town having been completely and thoroughly disinfected, the people began to return to their houses about the middle of April. By this time the active measures taken as regards the infected villages in the neighbourhood had also been successful, and it may be said that the end of May saw this alarming outbreak completely stamped out. The provinces have since then been entirely free from the disease.

Excluding those in Jawalapur and villages in its vicinity, no cases are known to have occurred in the North-Western Provinces and Oudh during 1898, though alarms were frequent. Nevertheless, the Sanitary Commissioner retains the opinion expressed in his report for 1897, that such cases must have occurred. The memorandum issued by the local government as to the measures to be adopted in small centres of population was, he believes, of great value, because it is probable that when an isolated plague case was imported into a rural centre the people themselves took the necessary steps of isolating the patient, etc., without making any report to the authorities.

The measures adopted for keeping plague out of the provinces, and for fighting it after it had gained an entrance, were on the same lines as those described in the report for 1897.

Plague in the Central Provinces.—From September 1896, when the existence of plague was first recognized in Bombay, up to November 1898, the protective measures which were at first adopted and which still continue to be in force in the Central Provinces, and which consist chiefly of inspection of railway travellers, disinfection of clothing, detention of suspected persons, and police supervision of new arrivals, were successful in preventing the disease from obtaining a foothold in the province. During this period 22 cases of plague were detected at the various inspecting stations, 16 of them in 1897. At the end of October 1898 the disease was communicated by a traveller to a person residing permanently in Khandwa. In the first week of November the disease appeared in an epidemic form in the town of Hinganghat, extending afterwards to Wardha, and several villages in the Wardha district, also to the towns of Nagpur and Bhandara before the close of the year. At Khandwa the action taken was prompt and vigorous, and the disease spread no further. The precise origin of the outbreak in Hinganghat will never be known. The infection was doubtless brought in some way from Bombay, but whether by human agency or through the medium of goods brought by railway has not been discovered. It is, however, certain that the disease must have been in existence in the town for many days before it was actually recognized. Had this not been so, it doubtless might have been stamped out at once, as at Khandwa. The measures taken to combat these outbreaks were much the same in all cases. Briefly, they consisted of—

(1) Evacuation of the infected block in the first instance and eventually of the *mohalla*, including—

(*a*) Isolation of the sick ;

(*b*) Segregation of contracts ;

(*c*) Formation of observation camps for the other inhabitants ;

(2) Preliminary disinfection of infected houses ;

(3) Unroofing and thorough exposure to sunlight ;

(4) Final disinfection and cleansing prior to re-occupation ;

(5) Disinfection of grain ;

(6) Prophylactic inoculation.

"The total number of persons inoculated amounted to only 653. Its value is now, however, becoming generally recognized, and it is most satisfactory to find that the people

everywhere showed the greatest readiness to take advantage of it." From the experience hitherto gained the Administration concludes that careful railway inspection is a most valuable and indispensable protection against the importation of plague; that early intelligence of a first case of plague and prompt isolation of the sick person and those who have been in contact with him is of supreme importance, and decisively effectual in preventing the spread of infection; that, after isolation, immediate evacuation is the first and most effectual measure, but that to be effectual it must be complete, all communication with the evacuated block of houses being cut off; that when the infection is established, a house-to-house visitation is the only effectual means of bringing cases to light; that it is dangerous to allow people to establish scattered camps in such numbers or positions that control is difficult or impossible; that if disinfection has been thoroughly done, re-occupation may safely be allowed after the expiry of a period of six weeks from the occurrence of the last case.

The Sanitary Commissioner states that in no instance was there any fact disclosed in support of a theory of dissemination by the agency of rats or other vermin, except in so far that the death of rats at Hinganghat and Wardha coincided with the appearance of the disease among human beings, and that in the Khandwa outbreak and in another occurrence in the Deputy Commissioner's compound at Wardha, the mortality among rats occurred after the appearance of the disease among human beings.

Plague in Mysore.—The situation of Bangalore as the point of convergence of four lines of railway always rendered it liable to the importation of Plague. Two of these lines, namely, the main Southern Maratha Line, which runs directly from Poona, *viâ* Dharwar, Hubli, and Belgam, to Bangalore, and the branch to Guntakal, which joins the main line running *viâ* Sholapur and Poona, connected Bangalore with several centres of the disease in the Bombay presidency. Anxiety was therefore early felt at the possibility of infection by this means, and immediately on the passing of the Epidemic Diseases Act (III. of 1897), steps were taken to establish a system of railway inspection. Although the first case of plague in Bangalore occurred in the civil and military station, it could have had no connexion with the outbreak that immediately followed it in the city. This case was the servant of a railway official who arrived with his master from Hubli on the 11th August, and was found to be ill on the 12th. On the 13th cases were found to have occurred in railway cooly families living near the railway sheds of the Southern Mahratta Railway. These coolies worked at the railway transhipping goods-sheds; the disease was confined for some time to these people and their friends; and the entrance to the goods-shed is extremely close to the first infected houses. It seems, therefore, that the importation of the plague was due in some way to the Southern Mahratta Railway; but whether the infection was brought by railway servants from Hubli, or by clothes belonging to infected persons, or by goods or by rats, it is impossible to say. At the same time, the fact that it was the coolies in the goods-shed, and not the other railway servants, that were first affected, rather points to the latter two sources. The diagnosis of the first cases was verified by bacteriological examination. The disease at first spread very slowly. Its progress by months and districts is shown in the following table, as well as in that given on page 108.

No.	Districts.	August.		September		October.		November.		December.		Remarks.
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
1	Bangalore City	22	15	227	138	1,393	1,095	1,313	1,099	322	252	
2	Mysore City	...	...	...	...	9	5	4	7	41	28	
3	Bangalore District	...	...	7	7	120	101	291	214	1,676	1,518	
4	Mysore District	...	...	2	2	9	7	63	59	64	45	
5	Kolar District...	...	...	2	2	53	39	88	67	267	216	
6	Tumkur District	...	...	2	2	20	15	136	99	404	293	
7	Hassan District	...	...	...	...	1	1	1	...	...	...	Imported cases only.
8	Kardur District	...	...	...	...	4	4	1	1	1	...	
9	Chitaldroog District	...	...	...	...	4	3	1	1	1	...	
10	Shimoga District	...	...	...	...	...	...	...	...	...	...	

An endeavour was made to keep in view for ten days all who arrived in Bangalore, and, by a system of passes, to prevent men likely to carry infection from leaving. Unfortunately from ignorance and timidity, the inhabitants gave no help or were, for the most part

passively, obstructive: so that for long the detection of cases, the segregation of the sick and those in contact with them, and the evacuation of infected localities were only partially attained. As these are measures which can be successful only when complete, it was difficult to get the disease in hand. The staff of the plague hospital, too, deserted, and a new staff had to be imported. Such was the fear of the inhabitants that they not only deserted their dead in their houses, but cast them forth to the number of over 200 into the roads, tanks, and wells. In fact, it was found impossible to "fight the people and deal effectively with the plague at the same time" and the rigour of the original regulations and measures had to be somewhat relaxed, in doing which, however, great care had to be taken that things did not slide to the opposite extreme. In some few cases at Mysore, the attitude of the Mahommedan inhabitants was threatening, and the Durbar authorities had considerable difficulty in dealing with them. At Bangalore trusting to death certificates was found useless, as was the refusal of burial without a certificate. The only measure of the kind at all successful was the making it penal to remove a body from a house without a certificate. Strange to say, the population, so adverse to the other measures meant for their good, took kindly to inoculation. Accurate statistics are not available; but the numbers reported are 30,758 first inoculations and 968 second inoculations by civil officers, and 11,815 first inoculations and 5,639 second inoculations by military officers. Of the civil inoculates, 379 were reported to have been attacked and 263 to have died.

Rewards were offered for the destructiou of rats; and in a report dated November it is noted that dead rats teeming with plague bacilli had been found in every quarter of the city and station of Bangalore, so that the entire locality appeared to be infected,

Plague in the City of Madras.—Thirteen imported and two indigenous cases of plague occurred in the city of Madras. Precautions against the spread of infection were strictly carried out. When the plague broke out at Bangalore, a scheme of defence was drawn up with the aid of the Sanitary Commissioner. Four plague hospitals and four segregation camps were organised and opened by the Madras Municipality. A system of surveillance and passports was adopted which aimed at keeping every passenger from infected districts under observation for ten days. The system worked fairly well, but of course, a certain percentage of arrivals altogether escaped observation and could not be traced by the sanitary staff or the police. Further precautions included a daily scrutiny of the mortality all over the town. A reward was given for each dead rat brought to a police station, The tail of each rat was cut off, to prevent the rats being brought twice, and twice daily the rat bodies brought in were removed and cremated. But the numbers brought in did not show any tendency to diminish; there was some suspicion that persons might be induced to breed them for the sake of the reward, and it was known that field rats were constantly being brought in; so the reward was reduced. In accordance with the rules of the Venice Convention, 68 vessels, arrivals from Bombay and Calcutta, were inspected, when between two and three miles from the port, and all passengers were inspected on shore prior to embarkation. No plague cases were detected.

Plague in the Madras Presidency.—The general figures are given in the table on page 108. Plague in an indigenous form first appeared in Guntakal in the Anantapur district, in the beginning of August 1898, *i.e.*, at about the same time as it attacked Bangalore, both places being probably infected from the same source, *viz.*, Hubli. From Guntakal the disease spread to other parts of the Anantapur district and to the districts of Bellary and Kurnool. The epidemic was then rapidly extending in Mysore; and the districts of Salem and North Arcot, which are nearest to the infected portion of that province, were attacked early in December 1898. The Sanitary Commissioner notes that in no instance was a case of plague reported as having originated from infected articles received from any locality outside the presidency. The origin of the disease was always found to be due to human beings suffering from the disease arriving from an infected locality. It was not till areas having close *passenger* traffic with Mysore became infected that the Madras presidency fell a victim to indigenous plague. The measures of railway and ship inspection dated from early in 1897. The object of the methods adopted was to ensure that arrivals by road, rail, or sea should be subjected to surveillance for a period of ten days to *whatever part of the presidency they proceeded.* This was secured by the giving of a document under the Additional Regulations, requiring the persons to present themselves before certain local authorities appointed in municipal and rural areas—a method familiarly known as the "passport system." Considering the number of localities into which plague was imported and the number of times it was imported into

one place, the Sanitary Commissioner thinks this method was very effectual; though it has been objected by others that the system was not and could not be thoroughly carried out, and that there may have been other circumstances that prevented the plague from spreading. In all the railway inspection stations opened up to the end of 1898, 1,792,603 passengers were examined. Of these, 9,633 were detained for observation. The chief measures for combating an outbreak of plague were the entire evacuation of the infected locality at an early stage of the epidemic; the removal of the people of the infected area to temporary shelter in the open air, and the stoppage of all direct communication between them and their houses and the surrounding healthy villages until the disease had abated; the thorough disinfection of houses by means of sepoys or trained coolies under efficient supervision. The greatest success was obtained where these measures were carried out thoroughly, and the Sanitary Commissioner remarks that evacuation of indigenously affected areas was found, as in all epidemics of this disease that history has recorded, to be the best sanitary measure. Early in September 1898 orders were issued to start *voluntary* inoculation by Haffkine's prophylactic both in the town of Madras and in the presidency where there were commissioned medical officers. Up to December, 5,685 inoculations were performed in the city and 10,532 in the presidency, making a total of 16,217. With right, however, the Sanitary Commissioner consistently opposed advice tendered to government from time to time to neglect or abolish necessary sanitary measures in favour of inoculation alone.

Plague in Hyderabad State.—The figures for Hyderabad will be found in the table on page 108. The following is shortened from the report of the Plague Commissioner:

In 1898 there were two epidemics of plague in the Hyderabad State. The first began in the cold weather 1897–98, and was confined to the western border of the State. It reached its height in February, during which month there were 616 cases with 545 deaths; and died down in May and June, the months in which the people sleep outside their houses. The second epidemic began in September, and reached its maximum in November, when there were 1,442 cases and 1,228 deaths. In both epidemics villages in the vicinity of rivers, nullahs, and tanks, were more affected than those situated on high dry land; plague was confined almost entirely to black cotton soil districts; plague occurred principally in districts in which salt is manufactured from the soil. The infection appeared to be spread entirely by human agency. The infection having been conveyed into a house, the house itself becomes infected. The virus is deposited in the floors, the dust of which constitutes the principal medium by which the infection is propagated from one human being to another. Evacuation proved to be the only measure which arrested the progress of the epidemics. After 21 days in camp without cases or deaths, the villages were disinfected, and the inhabitants were then allowed to return to their homes. The mud floors of every house were dug out to a depth of from one and a half to two inches, the dug out portions were removed to a kiln outside the house, and burnt to ashes, and the floors were remade with fresh field earth. This process, and no other was employed, was carried out by the villagers themselves at their own cost. Detention camps were in full operation at the principal stations on the railways leading into Hyderabad throughout the year. Search parties marched from Hyderabad along every road leading to the infected frontiers, and searched every town and village *en route* for cases of plague, a reward of ten rupees having been offered for each case discovered. Experimental work was carried out in the temporary laboratory of the Hyderabad Medical School by Dr. Mullanah and his assistants.

Plague in Rajputana.—In Rajputana occurred 8 imported cases with 7 deaths and 140 indigenous cases with 117 deaths. The indigenous cases all occurred in the Sirohi State, the village of Kalindri being the most severely affected, and after it Teuri and Sheudial, while the remaining village, Wardra, had only 8 cases with 7 deaths. The monthly distribution of the disease is given in the table on page 108.

The Rajputana border has been extensively exposed throughout the Bombay epidemic to plague infection on account of its position. Moreover, the enterprising character of the Marwari takes him all over India to engage in trade, while he keeps up house and family connections in Rajputana. Consequently, when plague broke out in Bombay and the Deccan, the Marwaris returned in thousands, and extensive observation camps had to be arranged all along the lines of rail and road, as well as outside the cities, towns, and villages throughout the province. Platform inspections of all passengers from infected areas were carried out at Abu Road, Ajmere, and Bandikui; and all passengers who alighted at Rajputana, at stations on the Rajputana Malwa or the Jodhpore-Bikanir Railway were regularly examined, and segregated if found to be suffering from suspicious fever or if likely to endanger the public health in entering the villages. The imported sick and their attendants were carefully isolated in separate hospital camps, and when a patient died or recovered, everything, including the hut in which the case had been treated, was burned. In the summer of 1897 camps were started at the different railway stations for detaining arrivals from plague-infected districts. It was owing to the native officials

in charge of one of the camps having failed to carry out, in the case of a rich bania, the duties entrusted to them, the plague was introduced into the Sirohi State. In the middle of November 1897, this wealthy Seth found his way into the village of Teuri in the Sirohi State, and died there of plague. His funeral was well attended, and it was very soon followed by an outbreak of indigenous plague in this and three other villages adjacent. The villages were early vacated and disinfected, and the outbreak seemed to stop; but the weather was extremely cold at the time, and the people could not be kept out of their houses, so other cases soon occurred after re-occupation, and at the same time Poona refugees were attacked in the town of Kalindri, which had a population of over 4,000 and was only two miles distant from one of the villages early infected. Plague was at first confined to Poona refugees and their families and connections, but it afterwards spread to others in the towns, and to some of those residing at their wells some distance away. As soon as the recrudescence took place, the towns were all again promptly vacated and the people kept out in camps. The encampments were widely scattered over the fields. The huts were burnt and the sites were changed when cases occurred in them, those exposed to infection were freely disinfected, and the sick and their attendants were carefully segregated. Nevertheless, cases continued to occur till the hot weather had well set in. The nature of the disease was recognized by the villagers, who call it *chua ka rog* (rat's disease). The infected villages were entirely evacuated by the 20th January, after which date only officials were allowed to enter. The disease continued at Kalindri in epidemic form until the end of February, and sporadic cases occurred up till the 16th March. After that date three suspicious deaths were noted, and all precautions were taken as for plague. The last attack in Teuri occurred on 31st January, and in Sheudial on 2nd February. These two villages are much smaller than Kalindri, and so more easily controlled. But the early disappearance of plague from them is to be explained chiefly by the fact that there was not such a strong opposition to going into camp, and the people were moved out ten days before those of Kalindri. After an interval of a week, allowed for free ventilation, the plague houses were disinfected with perchloride of mercury solution (1 in 1,000). Then the floor of every house was dug up, and the earth carried outside and burnt. Lastly the interior of every house was thoroughly lime-washed. The houses remained unroofed until after the re-occupation of the villages on 23rd April. Excellent work was done by the Sirohi Durbar. When it is seen how plague spread elsewhere, it seems no exaggeration to say that the vigilance of the Durbar saved from a general epidemic not only the State of Sirohi but the whole of Rajputana.

Plague in Central India.—There were no indigenous, only imported, cases in the Central India Agency, either found in the trains at platform inspection stations, or, as the case in Bhopawar, imported from a plague-infected area.

Plague in Baluchistan.—The 18 deaths from plague all occurred in persons who contracted the disease in Kurrachee, and who fled from there into the Las Beyla State. There were no other cases in Baluchistan.

Plague elsewhere.—There was no plague in Burma, Assam, Coorg, or Berar. Arrangements were made to prevent the entrance of the disease into those provinces, and to fight it if it did effect an entry.

Fevers.

The fever-mortality ratio of India for 1898 was considerably below that of 1897, as well as that of the five-year period 1893–7; and the number of deaths fell from 5,026,725 in 1897 to 3,866,650. The maximum months of death were November, October, and December, and the minimum July, February, and June. The highest ratios were those of Coorg and the North-Western Provinces and Oudh, and the lowest that of Madras. The greatest reduction of ratio as compared both with 1897 and with 1893–7 was in the Central Provinces. Except in four provinces, the rural mortality was higher than the urban, the North-Western Provinces and Oudh being, as usual, one of the exceptions. Disregarding Ajmer-Merwara, the highest rural district ratio in India was that of Naini Tal in the North-Western Provinces; and the highest town ratio was that of Belgam in Bombay. No districts and only four towns in India were free from fever-mortality.

The following table, which is believed to include plague, may be consulted not only for this, but also for the succeeding paragraphs dealing with fevers in the individual provinces :—

Statement showing the deaths from Fevers registered in the different Provinces by Months during the year 1898.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1898.	1898.	1897.
Bengal	140,477	100,847	116,858	110,473	114,251	86,583	88,831	119,665	114,252	136,725	151,483	139,038	1,419,483	19·97	23·62
Assam	8,441	7,086	7,242	7,724	9,059	8,827	9,698	9,259	9,281	8,993	9,833	9,520	104,963	20·90	28·74
North-Western Provinces and Oudh.	96,094	67,317	72,966	81,378	83,576	85,624	70,362	75,841	91,371	117,583	111,515	109,969	1,063,596	22·67	31·21
Punjab	40,567	27,263	27,173	28,808	34,822	36,884	28,692	31,221	35,070	43,075	43,824	40,807	418,206	20·35	20·57
Central Provinces*	16,943	12,932	12,403	13,280	14,301	11,267	9,203	11,286	11,582	14,938	13,873	13,920	155,928	16·41	40·98
Berar	3,278	2,648	2,911	2,920	2,332	1,580	1,738	2,491	2,892	3,093	3,486	3,420	32,789	11·49	23·00
Lower Burma	5,959	4,590	4,192	3,794	3,648	3,913	4,747	4,938	4,279	4,277	4,558	4,802	53,697	11·90	11·46
Madras Presidency	26,269	19,529	20,372	18,306	19,601	20,103	22,038	21,016	19,434	18,982	20,765	22,223	248,638	7·48	8·97
Bombay Presidency	28,108	24,226	25,264	20,242	18,075	15,200	17,626	23,158	27,985	36,640	36,415	29,576	302,515	16·07	24·05
Ajmere-Merwara	972	939	924	738	654	643	512	655	669	583	648	752	8,689	16·02	20·07
Coorg	487	363	455	414	413	452	460	405	386	289	264	288	4,876	27·02	41·50
Mysore	5,684	4,638	6,148	5,781	3,891	3,723	3,753	3,666	3,484	3,801	4,175	4,857	55,601	11·07	9·72
Total	373,279	272,378	296,908	293,858	304,623	274,799	257,660	303,601	320,685	388,979	400,839	379,172	3,868,781	17·73	23·12

* Excluding Zamindaris.

Sale of Quinine at Post Offices.—In Bengal there was a decrease of 3,610 parcels of quinine sold, each parcel containing 102 five-grain pice packets. The decrease, it is said, was most likely due to the exceptional healthiness of the year, and consequently to the demand for quinine being less.

In Assam the sale of quinine is said to have been on the whole satisfactory, though the vaccinators are not considered good mediums for its sale; and it is suggested that in future the secretaries of village schools should also be employed for the purpose.

Quinine is now sold at all post offices, and by all the vaccination staff in the North-Western Provinces and Oudh. In addition large quantities were sent to magistrates of districts who had found the amount in hand for gratuitous distribution insufficient. Altogether 10,604 packets were issued, the distribution being made from the district jail, Aligarh.

No statistics are given for the Punjab, but with regard to various districts it is mentioned that gratuitous distribution was made through the vaccination staff, the police, and headmen of villages.

The Central Provinces, Berar, Bombay, and Madras do not appear to have furnished particulars of quinine sales.

The sale of quinine powders continued to be appreciated by the public in Coorg, and 34,742 were sold by the post offices.

In Lower Burma 2,103 pice packets were distributed during the year. The Sanitary Commissioner remarks that the scheme for the distribution and sale of quinine does not appear to make satisfactory progress, and that its success or otherwise rests primarily with the higher district officials. He discusses the chief obstacles to success and their remedies.

Bengal.—In Bengal the mortality attributed to fevers was below that of the previous year, and below the mortality of the quinquennium as a whole. The statistics will be found in the above table. The maximum months were November, January, and December, and the minimum June, July, and February. Each month except January had a smaller number of deaths than the corresponding month of the preceding year. The Sanitary Commissioner remarks that the year was a generally healthy one, and that there was a plentiful outturn of crops almost everywhere. The highest rural district ratio was that of Noakhali, followed by those of Dinajpur, Jalpaiguri, Rajshahi, Faridpur, Purneah, and Malda; and the lowest was that of Puri. The fever at Rajshahi seems to have been partly influenza, and that at Malda was ascribed to prolonged inundations.

The opinion that the effect of short rainfall on the public health depends to some extent on the character of the country was supported by the answers of civil surgeons to inquiry on the point. Thus, rain-floods are more apt to be beneficial in high-lying than in low-lying tracts. With regard to the effect on health of jute-steeping the opinion of civil surgeons was found to be divided. The Sanitary Commissioner sums up as follows :—

It is extremely difficult to estimate to what extent jute-steeping acts as a factor in increasing the fever mortality of Bengal. The water of tanks and pools in which jute is steeped is seriously polluted and rendered unfit for human consumption, and the stench which emanates from the decomposing jute vitiates the surrounding atmosphere ; but the extent to which these two factors affect the public health depends, on the one hand on the extent to which the water thus polluted is used for drinking or domestic purposes, and, on the other, to the proximity to dwelling houses of those places in which the jute is steeped ; in other words, it depends on local conditions. In Eastern Bengal, where jute is most extensively grown, a large part of the country is subject to inundation, and during the period (generally from July to September) when jute-steeping is carried on, the rivers are overflowing and washing away everything, thus considerably diminishing the evils of water contamination. It is also noticeable that the fever mortality in all these districts is as a rule low during June, July, and very high during October to January.

The highest town ratio was that of Malda in the Malda district, and the next that of Kumarkhali in the Nadia district ; and the lowest ratios, in order, those of Kendrapara in Cuttack, Purulia in Manbhum, and Jhalakati in Backergunge.

Two deaths occurred among European seamen, one from enteric fever ; and forty in the native floating population. The ratio in both cases was below that of the preceding year.

Assam.—The Assam statistics of fevers are given in the table on page 119. The mortality ratio, though somewhat above that of the quinquennium, was much below that of the preceding year. November, July, and December were the maximum months, and February, March, and April the minimum. There was a reduction in the number of deaths in all months, except January and February, the greatest reductions being in June and July. The highest rural district death-rate was that of Nowgong, and the next that of Goalpara ; while the lowest was that of Sibsagar. The Sanitary Commissioner mentions that tha Sibsagar and Lakhimpur districts always show the least mortality from fevers, but that they are being reached by the wave of epidemic malarial poisoning a year after its attack on Cachar and Sylhet. The highest town ratio was that of Golaghat in Sibsagar, and the lowest that of Shillong.

The number of deaths recorded as from *kala azar* was less by 2,140 than in 1897, but more than in any of the three years preceding that. The Sanitary Commissioner writes :—

These 16,472 cases are included in the total of 104,963 cases, reported as due to fevers, whence it appears that nearly one-sixth of the total loss from fevers of all sorts is due to this scourge. The bulk of the cases are reported, as in former years, from the Nowgong district, many whole villages in which have no doubt been entirely depopulated or deserted ; but still I must say that I consider the figures as they stand to be utterly unreliable. I fully agree with Colonel Stephen that many, indeed the great majority of deaths which in former years would have been registered under ordinary fevers, are now returned as *kala azar*. It is impossible to suppose that in 1898 of the 11,887 persons who died from fevers of all sorts in this district, 10,515 were sufferers from *kala azar* while the ordinary malarial fevers of the country caused only 1,372 deaths. It is impossible to review satisfactorily figures which are so hopelessly inaccurate. So much has been written by officers specially deputed to investigate and report on this disease, that I refrain from saying more than that it appears to be gradually dying away from the province as a whole, and especially so from the Lower Assam districts, such as Goalpara and Kamrup, while it may possibly be slightly increasing in Darrang, and its invasion into Sibsagar is feared. Special precautions are now being taken to treat all suspicious cases occurring, and, if possible, to prevent its spread in this latter district ; though it is to be feared that both it and Lakhimpur will suffer in their turn.

North-Western Provinces and Oudh.—Mortality from fevers in the North-Western Provinces and Oudh in 1898 was much less than in 1897, and considerably less than the mortality for the quinquennium as a whole, as may be seen in the table on page 119. The highest numbers of deaths occurred in October, November, and December ; and the lowest in February, July, and March. Every month, except June, saw a reduction, as compared with the corresponding month of the previous year. The Sanitary Commissioner states that the course of the disease was normal, and presented no peculiar features. The highest rural district ratio was that of Naini Tal ; and next in order were the ratios of Bareilly, Pilibhit, Saharanpur, Bulandshahr, and Mainpuri. All those rural districts have usually high ratios. Excluding Ajmer-Merwara, the ratio of Naini Tal was also the highest rural district ratio in India ; and next to that of Coorg the general rural mortality was the highest in India. The highest town ratio was that of Manglaur in the Saharanpur district ; and Najibabad, Ghaziabad, Jalesar, Muzaffarnagar, Gonda, Aonla, Sirdhana, Sikanderabad, Mainpuri, and Gangole had ratios above 35 per 1,000. The

lowest town ratio was that of Nawabganj in the Bara Banki district. This province had the highest general urban mortality from fevers in the whole of India, and it was one of the four provinces that showed a rural mortality lower than the urban.

Punjab.—In the Punjab fever mortality was slightly reduced as compared with that of the previous year and with that of the quinquennium as a whole. The figures are given in the table on page 119. The months that had most deaths were November, October, and December, and those of fewest March, February, and July. Each of the first eight months of 1898 had more, and each of the last four fewer, deaths than the corresponding month of 1897. The highest rural district ratio was that of Dera Ismail Khan, and the lowest that of Simla ; the highest town ratio that of the Dajal in the Dera Ghazi Khan district, and the lowest that of Talamba in the Mooltan district. Palwal in the Gurgaon district, Lakki in the Bannu district, and Bhakkar and Dera Ismail Khan, both in the Dera Ismail Khan district, had also ratios over 30 per 1,000.

Central Provinces.—The statistics of fever mortality in the Central Provinces are to be found in the table on page 119. The mortality was nearly two and a half times less than in 1897, and more than one and a half times less than the mortality of the quinquennium as a whole ; and no other province showed so great a reduction. Every month of the year shared in the reduction, but it was greater from June onwards than in the first five months. The maximum months were January, October, and May, and the minimum July, June, and August. The year was one of recovery from the effects of privation and famine. The highest rural district ratio was that of Nimar, the next that of Burhanpur, and the lowest that of Sambalpur. Of town ratios the highest was that of Burha in Balaghat, the next that of Bankheri in Hoshangabad, and the lowest that of Narkar in Nagpur.

Berar.—The fever mortality of Berar, as may be seen in the table on page 119, was less than half that of the preceding year, and somewhat more than half that of the quinquennium as a whole. The highest numbers of deaths occurred in November, December, and January, and the lowest in June, July, and May. The reduction was greatest in the months May–October ; but January and February were the only months in which there was no reduction. The Sanitary Commissioner ascribes the lessening of fever mortality to reduced temperature, humidity, and rainfall. Berar was one of the four provinces that had the rural mortality below the urban. The highest rural district ratio was that of Wun, and the lowest that of Buldana ; the highest town ratios those of Ellichpur Civil Station in Ellichpur and Wadegaon in Akola, and the lowest town ratio that of Karajgaon in Ellichpur.

Madras.—The table on page 119 shows that the fever mortality of Madras in 1898 was lower than in 1897 and lower than that of the quinquennium as a whole, and that it was lower than that of any other province. The months of maximum death-numbers were January, December, and July, and those of minimum death numbers April, October, and September. In the first three months of the year there were more deaths than in the corresponding months of 1897, but in all the other months fewer, the reduction being greatest in the last quarter of the year. The Sanitary Commissioner says :—

> It is a trite statement, but one necessary to be held in mind, that under the head of "Fevers" the majority of all affections in which pyrexia is a prominent symptom are likely to appear, as a sequence of the present system of registration and state of medical advance of the country. Nevertheless, it is safe to assume that the greater number of deaths so registered are due to malaria.

He mentions cases in which, to escape inquiry, cholera was registered under "Fevers," fever under "Other causes," and plague under "Other causes." The Sanitary Commissioner also indicates his belief that the period of greatest mortality from fever is that which immediately follows the greatest fall of the subsoil water level, and heralds a commencing rise ; and that a fall subsequent to a great rise will be followed by increased mortality.

Of all the provinces Madras had the lowest rural mortality. The highest district ratio was that of the Nilgiris, and the lowest that of Tanjore. Madras had a lower urban mortality than any other province. The highest town ratio was that of Kampli in Bellary, and the lowest that of Rajahpalaiyam in Tinnevelly.

Coorg.—In Coorg the fever mortality, though higher than that of the decennium as a whole, was much reduced from that of the previous year. Of the provincial ratios that of Coorg was the highest; and Coorg had also the highest rural mortality. The reduction was greatest in June, July, and the months of the final quarter; but all the months except the first three shared in it. January was the maximum month and November the minimum. Naujarajapatna had the highest rural district ratio, and Kodlipett the highest town ratio.

Bombay.—As may be seen in the table on page 119, the Bombay fever death ratio was considerably below that of the preceding year and that of the five-year period. Every month of the year had fewer deaths than the corresponding month of 1897, the reduction being greatest in June and July. Deaths were most numerous in October, November, and December, and least numerous in June, July, and May. The figures shown in the tables include plague. If it were excluded, there would remain 216,324 deaths ascribed to fever, giving a ratio of 11·49 per 1,000. Such a ratio would class the year as one of the healthiest in the last eleven years, the people being in a state of rapid recovery from the famine of the previous year. The Sanitary Commissioner says:—

> With the agency at our disposal for the registration of deaths, and in a country where so many diseases are by the people called fever, it is inevitable that many diseases must be returned under the head of "fever" which do not rightly belong to this heading. This has always been the case, and, although these fever deaths cannot be relied on as being all due to fever, they can, when taken for a number of successive years, give an indication as to the prevalence or otherwise of the common fevers of the country. The carrying out of plague measures in some of the towns of the presidency has led to very much more accurate registration in them.

Bombay was one of the four provinces that had a rural ratio lower than the urban. The highest rural district ratio was that of Dharwar, the district invaded in greatest force by plague, that of Broach coming second; and the lowest that of Ahmednagar. The highest town ratio, which was also the highest in India was that of Belgam, a city attacked by the plague. The same explanation applies to the high ratios of Belgam Cantonment and of Gokak. The lowest town ratio was that of Ahmednagar Cantonment.

Lower Burma.—Lower Burma was the only province, besides Mysore, in which the death ratio from fevers was higher than both the ratio of 1897 and the period ratio for the quinquennium. The elucidatory figures will be found in the table on page 119. The increase was confined to the first six months of the year, each of the last six months showing a decrease. January, August, and December saw most deaths, and May, April, and June fewest. The Sanitary Commissioner considers that if it were possible to differentiate diseases by a professional agency possessed of some degree of medical knowledge, probably not less than 50 per cent. of the fatality ascribed to this cause would come under other heads. The highest rural district ratio was that of Akyab, the ratios of Sandoway and Toungoo not being far behind, and the lowest that of Hanthawaddy. Shwegyin, followed by Myaungmya, had the highest town ratio, and Danubyu the lowest. The fever mortality of 9 towns of Upper Burma taken together was 8·59 per 1000, which is very near the urban mortality of Lower Burma.

Dysentery and Diarrhœa.

The mortality for India from dysentery and diarrhœa was reduced by 47 per cent. as compared with that of 1897, and 20 per cent. as compared with that of the quinquennium as a whole. The highest numbers of deaths occurred in the months of August, January, and September, and the lowest in April, March, and June. Every month, except January, showed a reduction as compared with the corresponding month of 1897, the diminution being greatest in the four months July–October.

The highest provincial death-rates were those of Berar, Assam, and Bombay; the lowest those of the North-Western Provinces and Bengal. The ratio of every province showed a decrease, except that of the Punjab, which was unchanged, and that of Ajmer-Merwara, which rose. The last-named province was the only one of which the ratio was increased as compared both with that of 1897 and with that of the quinquennium. The decrease as compared with the preceding year was in the case of the Central Provinces, and the greatest as compared with the five-year period in Berar. The decrease for India was connected with the return of the seasons to the normal, and the consequent passing away of famine and privation.

The following statement illustrates not only what has just been written, but also the succeeding paragraphs upon bowel complaints in the different provinces :—

Statement showing the Deaths from Dysentery and Diarrhœa registered in the different Provinces by Months during the year 1898.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1898.	Ratio of deaths per 1,000 of population. 1898.	1897.
Bengal	4,720	3,255	3,226	2,968	3,391	2,513	2,214	3,000	2,792	2,892	2,941	3,243	37,155	0·52	0·75
Assam	1,453	1,057	1,033	1,062	1,463	1,489	1,500	1,425	1,481	1,543	1,408	1,325	16,239	3·23	4·61
North-Western Provinces and Oudh.	2,097	1,550	1,514	1,722	2,021	2,088	1,972	2,241	2,171	2,285	1,972	1,941	23,574	0·50	1·25
Punjab	1,108	694	698	896	1,217	1,105	1,054	1,536	2,184	2,192	1,771	1,292	15,747	0·77	0·77
Central Provinces*	1,704	1,031	966	875	862	764	888	1,157	1,128	936	747	664	11,722	1·23	8·53
Berar	1,014	690	838	728	554	449	725	1,162	1,200	899	823	860	9,942	3·48	10·36
Lower Burma	505	525	461	645	877	938	1,146	889	656	491	467	432	8,032	1·78	1·95
Madras Presidency	2,797	2,235	1,805	1,608	1,818	1,975	2,622	2,770	2,692	2,765	3,195	3,372	29,654	0·89	1·19
Bombay Presidency	5,179	3,920	4,133	4,165	3,628	3,430	4,419	6,271	5,784	5,733	4,831	5,296	56,789	3·02	4·57
Ajmere-Merwara	40	31	27	53	50	28	39	114	60	27	33	47	549	1·01	0·81
Coorg	19	12	18	15	23	31	22	21	12	8	4	4	189	1·09	3·11
Mysore	532	431	460	359	371	406	548	626	528	870	815	783	6,729	1·39	1·47
Total	21,168	15,431	15,179	15,096	16,275	15,216	17,149	21,212	20,688	20,641	19,007	19,259	216,321	0·99	1·86

* Excluding Zamindaris.

Ajmer-Merwara was the only province that had a percentage of rural districts without mortality ; but, on the other hand, the same province and Assam were the only ones in which there were no towns without mortality. The highest rural district ratio was that of Lakhimpur, and the highest town ratio that of Golaghat, both in Assam. The general rural mortality was highest in Berar and Assam, and the general urban mortality in Assam and Coorg. Only in Berar was the rural mortality greater than the urban.

Bengal.—In Bengal the mortality from dysentery and diarrhœa was reduced as compared both with that of 1897 and with the period ratio of the quinquennium. The statistics may be obtained from the above table. The reduction affected every month except January and February, and was greatest in the period July–November. According to the Sanitary Commissioner, the large falling-off in the mortality was evidently due to the plentiful outturn of crops almost everywhere during 1897, which enabled the people to obtain wholesome food ; and it is noticeable that almost all the districts that were affected by the late famine show a smaller mortality from this cause during 1898. The highest rural district ratio was that of Darjeeling, and that of Howrah came next, followed by those of Balasore and Puri : all being rural districts which always return high mortalities. Uttarpara in the Hooghly district had the highest town ratio, followed, in order, by Serampore, Garulia, Baidabati, Bally, Howrah, Hooghly-Chinsura, and Dacca.

There were two deaths among European seamen and four in the native floating population, the respective ratios being 1·62 and 0·15.

Assam.—The statistical points of most importance as to the mortality in Assam from dysentery and diarrhœa are given in the above table. It was diminished both in comparison with that of 1897 and with that of the quinquennium as a whole. Every month showed a decrease, except January. The maximum months were October, July, and June, and the minimum March, February, and April. The Sanitary Commissioner, in pointing out the remarkable variations of mortality shown by the different districts, says that he knows of no difference in the vital conditions affecting the inhabitants of the upper and lower stretches of the great Assam river which could possibly produce them. The highest rural district mortality, which was also the highest in India, was that of Lakhimpur, and the lowest that of Goalpara. Golaghat, in the Sibsagar district, had the highest town ratio in Assam and in India, and of all the provinces Assam had the highest general urban mortality ratio. The lowest town ratio was that of Jowai in the Hill district.

North-Western Provinces and Oudh.—The mortality from dysentery and diarrhœa in the North-Western Provinces and Oudh, as may be seen in the table on page 123, was two and a half times less than that of 1897, and less than half the period ratio of the quinquennium. In every month of the year the reduction was great. The months of most deaths were October, August, and September, and those of the fewest March, February, and April. The highest rural district ratio was that of Garhwal, that of Almora being nearest to it, and that of Mainpuri lowest. Kashipur in the Naini Tal district had much the highest town ratio, the next in order being Hathras in the Aligarh district. The lowest town ratio, which was also the lowest in India, was that of Bindraban in the Muttra district.

Punjab.—The Punjab had a mortality ratio from diarrhœa which was exactly the same as in the previous year, and exactly the same as the ratio for the quinquennium as a whole. Reference may be made to the table on page 123. The greatest number of deaths occurred in October, September, and November, and the smallest in February, March, and April. Each of the first nine months saw an increase, each of the last three a decrease. The highest rural district ratio was that of Simla, which, like Gurdaspur, Gurgaon, and Delhi, usually has a high ratio ; and the lowest that of Hazara. Balabgarh, in the Delhi district, had by far the highest town ratio—those of Pind Dadan Khan in the Jhelum district, and Khanpur in the Hoshiarpur district being also high—and Muktsar in the Ferozepore district the lowest.

Central Provinces.—As the table at page 123 shows the Central Provinces had a mortality from dysentery and diarrhœa nearly seven times less than that of 1897, and more than two and a half times less than the period ratio of the quinquennium. The reduction in this province was greater than in any other, and affected every month of the year. The maximum months were January, August, and September, and the minimum December, November, and June. The Sanitary Commissioner views this marked decline in the death-rate from bowel complaints as evidence of the complete disappearance of famine and privation from among the people. The highest rural district death-rate was that of Sambalpur, and the lowest that of Bhandara. Seoni in the Hoshangabad district, Murwara in the Murwara district, and Damoh in the Damoh district, had the highest town ratios, and Umrer in the Nagpur district the lowest.

Berar.—In Berar the mortality from dysentery and diarrhœa was only about one-third of that of 1897, and about one-half the quinquennial period mortality. No other province showed so great a reduction from its quinquennial figure. The table on page 123 show the statistics. The months of greatest death-occurrence were September, August, and January, and those in which fewest deaths took place were June, May, and February. Of all the provinces Berar had the highest general rural mortality ; and it was the only one in which the rural mortality was greater than the urban. The highest rural district ratio was that of Ellichpur, and that of Wun the lowest. The Sanitary Commissioner suspects that in the Wun district deaths from dysentery were reported and classed as deaths from fevers. The highest town ratio was that of Nandura in the Buldana district, the next that of Karajgoan in the Ellichpur district, and the lowest that of Senderjana in the Amraoti district.

Madras.—Madras in 1898 recorded a mortality under this head which, while considerably below that of 1897, was somewhat higher than that for the five-year period. Particulars may be studied in the table on page 123. In all the months, except February and December, there was reduction in the number of deaths, but the reduction was greatest in the four months July–October. December, November, and January saw most deaths ; April, March, and May fewest. The Sanitary Commissioner believes that the diminution of mortality may fairly be regarded as due to improved dietary of the people following the fall in the price of grain. The highest rural district ratio was that of Chingleput, and the lowest that of Madura ; the highest town ratio that of Tuticorin in the Tinnevelly district, and the lowest that of Palin in the Madura district. Regarding Tuticorin, Cochin, Madras, and Coonoor, the Sanitary Commissioner mentions certain circumstances of soil and water pollution as explaining their high death-rates.

Coorg.—Coorg, as may be seen in the table on page 123, recorded a considerably reduced mortality from dysentery and diarrhœa. The reduction affected every month, but was most marked after March. Yedenalknad had the highest rural district ratio, and Veerajendrapett much the highest town ratio.

Bombay.—The mortality ratio of Bombay, under dysentery and diarrhœa, though lower than that of the previous year, was somewhat higher than the ratio for the quinquennium as a whole. Some statistical details will be found in the table on page 123. There was great decrease in each of the five months July–November, decrease in April–June and December, increase in February and March, and great increase in January. The maximum months were August, September, and October, and the minimum June, May, and February. In the opinion of the Sanitary Commissioner these bowel complaints are chiefly due to the after-effects of the famine. The highest rural district death-rate was that of Sholapur, the district which was most severely affected by the famine, as well as the one in which it continued longest. Nasik came next, and Upper Sind Frontier last. Nandurbar in the Khandesh district had the highest town ratio, and there were other high ratios in the same district; while Kaira in the district of the same name had the lowest.

Burma.—The table given on page 123 shows that Lower Burma had a mortality from dysentery and diarrhœa below that of the preceding year, but above that of the quinquennium as a whole. The months of most deaths were July, June, and August, and those of fewest December, March, and November. Compared with the corresponding months of 1897, January, May, June, October, and November showed increase, the others decrease. The highest rural district ratio was that of Thaton, the next being that of Tavoy, and the lowest that of Sandoway. Ma-ubin had the highest town ratio and Shwedaung the lowest. Nine towns of Upper Burma together gave a ratio of 0·98, much lower than the urban mortality of Lower Burma.

Injuries.

The deaths recorded under "injuries" are shown in the following statement.

When compared with the similar table in the report for 1897, it may be gathered that there was an increase in the number of deaths caused by snakes and wild beasts in several provinces, but especially in Mysore. (The figure printed opposite Madras as 260 in the 1897 table is a press mistake for 2,260.) The Sanitary Commissioner of Bombay notes that snake-bites were most frequent in the six months May–October, and in the districts of Ratnagiri, Hyderabad, Shikarpur, and Thana. In the Punjab there were 147 deaths from hydrophobia against 129 in the previous year. There was a great decrease of suicide in the Central Provinces after the increase that occurred in the time of famine and privation. In Assam a steady increase of suicide is noted by the Sanitary Commissioner. In Bengal in 1897 there had been an unusually high number of accidental deaths, due to the loss of life in the Chittagong cyclone; hence the diminution in 1898. In Bombay more females than males died by drowning, but more males than females by the other forms of injury.

Statement showing details of Deaths from Injuries registered in the different Provinces during the year 1898.

Province.	Population under registration.	Details of Deaths from Injuries.			Total.
		Suicide.	Snake-bite or killed by wild beasts.	Wounding, accident, and other injuries.	
Bengal	71,069,617	3,599	12,403	16,458	32,460
Assam	5,021,084	128	256	1,288	1,672
N.-W. Provinces and Oudh ...	46,904,791	2,600	5,629	16,512	24,741
Punjab	20,553,982	351	1,344	5,628	7,323
Central Provinces*	9,501,401	706	1,179	2,869	4,754
Berar...	2,852,825	150	174	652	976
Lower Burma	4,510,697	82	502	633	1,217
Madras Presidency	33,248,180	1,916	2,221	6,910	11,047
Bombay Presidency	18,820,346	668	1,530	4,786	6,984
Ajmere-Merwara	542,358	8	87	183	278
Coorg...	173,055	2	6	45	53
Mysore	4,843,523	132	2,782	872	3,786
Total	218,041,859	10,342	28,113	56,836	95,291

* Excluding Zamindaris.

All Other Causes.

The number of deaths recorded under this head was 1,376,725 against 1,476,672, and the ratio per 1,000 of population was 6·31 against 6·79. Every month of the year shared in the diminution except November and December, which showed decided increases. The maximum months were December, November, and October, and the minimum April, June, and May. The greatest decreases were in Berar and the Central Provinces, and the greatest increase in Bombay. The Sanitary Commissioners of Bombay and the Punjab mention that greater accuracy of return brings under this head cases which would formerly have been registered under fever. The former officer notices the tendency to put under this head cases of plague, so as to avoid the inquiry that might have been aroused by their return as fever. The same thing was noticed to a smaller extent in Madras.

Vaccination.

During 1896–97 the total number of persons vaccinated among the civil population of British India was 8,019,836 ; in 1897–98 the number fell to 7,829,983 ; and in 1898–99 the total showed a further decrease of upwards of three hundred thousand, and was only 7,497,597. The causes of the falling off in 1897–98 were mainly the presence of famine and plague, and although the effect on vaccination in 1898–99 of the recent famine was confined to diminished birth-rates in some of the provinces, the other cause was still unhappily persistent.

The actual presence of plague and the fear of its invasion have caused the diversion of the services of officers and subordinates ordinarily occupied in supervising and carrying on vaccination, while, among the people in many places, apart from the disturbance of the ordinary conditions of life, there is the unfounded dread that vaccination is being used as a cloak for anti-plague inoculation. So great was the terror of this in Coorg that vaccination had to be stopped altogether from November to March, and the operations performed during the year numbered only about half those performed in 1897–98.

The provinces in which the decrease occurred were Madras, Bombay, Bengal, the Punjab, Assam, and Coorg ; in the other provinces the number of operations was greater than in the preceding year. In Madras, Bombay, and Coorg, the falling off was due in one way or another to plague. In Bengal, in addition, there was the introduction of a more perfect method of vaccinating. In the Punjab a new system of itinerating among the vaccinators was misunderstood, and the vaccinators did not work well. In Assam, although malarial fevers were unusually severe in a part of the province, the chief cause of the falling-off was the unsatisfactory working of many of the staff.

Both primary operations and re-vaccinations were fewer than in 1897–98, the former falling from 7,186,888 to 6,913,977, and the latter from 618,065 to 583,602. The degree of success in primary operations was, however, somewhat higher in 1898–99 than in the preceding year, 94·02 per cent. having succeeded against 93·91 ; re-vaccinations, on the other hand, were less successful, 63·71 per cent. as compared with 64·44 per cent.

Among the different provinces the percentages of success varied greatly ; in primary operations, from 98·84 in Assam to 89·6 in Madras, and in re-vaccinations, from 93·4 in Assam to 23·1 in Berar. Extreme differences in results must be due in the main to divergence in the interpretation of the term " successful."

The percentages of success obtained by the staffs of dispensaries ranged, in primary operations, from 96·75 in Bombay to 72·80 in Coorg, and in re-vaccinations, from 90·63 in Assam to 52·96 in Bengal.

The ratio of the total population protected during the year fell from 31·53 per 1,000 in 1897–98 to 30·30 per 1,000 in 1898–99, the provincial ratios varying between 54·41 per 1,000 in Burma and 26·74 in Bombay.

As in the preceding year, the average number of operations performed by each vaccinator was highest in Berar, 3,020, and lowest in Bengal, 586.

Although there was a falling-off in the number of infants protected in Madras, Bombay, Bengal, Assam, Berar, and Coorg, yet the total in all provinces taken together was greater in 1898–99 than in 1897–98, rising from 2,815,592 in the latter to 2,853,132 in the former. The percentage of the total children born, estimated at 40 per 1,000 of the entire population, was 31·37 per cent. as compared with 30·95 per cent. in the preceding year, and ranged from 60·31 in Berar to 7·38 in Coorg.

The number of children between one year and six years of age who were successfully vaccinated fell from 3,172,881 in 1897–98 to 3,008,037 in 1898–99, the decrease occurring in Madras, Bengal, the Central Provinces, Assam, and Coorg.

The following statement shows in outline the working of the Department in the different provinces in 1898–99 and in the preceding year :—

Comparative statement of Vaccination in the different Provinces of India, excluding Ajmere-Merwara, in 1897–98 *and* 1898–99, *together with the death-rates from Small-pox during* 1897–98.

PROVINCE.		Population.	NUMBER OF VACCINATIONS PERFORMED. Primary.	Re-vaccinations.	TOTAL.	PERCENTAGE OF SUCCESSFUL CASES. Primary.	Re-vaccinations.	Persons successfully vaccinated per 1,000 of population.	Ratio of deaths from small-pox per 1,000 of population during the calendar years 1897 and 1898.	Average number of vaccinators employed in Department.*	Average number of operations per vaccinator.*
Bengal	1897-98	70,832,144	2,243,093	76,443	2,319,536	97·87	64·37	31·69	0·27	3,383	650
	1898-99	71,032,411	2,087,285	60,167	2,147,452	97·99	67·35	29·34‡	0·20	3,482	586
Assam	1897-98	5,634,258	272,707†	11,207	283,914†	98·77	90·96	49·61	1·08	222	1,065
	1898-99	5,634,258	237,088†	21,817	258,905†	98·35	93·78	45·02	1·03	219	981
North Western Provinces and Oudh	1897-98	47,146,033	1,318,912	66,093	1,385,005	89·66	63·47	25·97	1·86	866	1,599
	1898-99	47,146,033	1,340,561	58,665	1,399,226	91·58	71·22	26·93	0·05	875	1,598
Punjab	1897-98	20,553,982	626,589	212,235	838,824	94·39	60·63	35·04	0·78	299	2,799
	1898-99	20,553,982	657,518	177,558	835,076	94·85	58·69	35·41	0·24	297	2,808
Central Provinces	1897-98	12,944,805	347,210	51,489	398,699	96·67	87·70	29·42	0·38	274	1,391
	1898-99	12,900,386	383,633	65,617	449,250	95·92	81·77	32·69	0·10	274	1,588
Berar	1897-98	2,897,040	95,048	30,241	125,289	96·4	30·0	34·7	0·2	44	2,847
	1898-99	2,897,040	94,032	38,871	132,903	97·1	23·1	34·6	0·2	44	3,020
Burma	1897-98	8,146,855	405,469	26,081	431,550	94·56	59·74	48·97	0·41	167	2,526
	1898-99	8,146,855	447,259	33,398	480,657	94·60	60·13	51·41	1·07	177	2,635
Madras	1897-98	35,651,577	1,189,146	82,583	1,271,729	89·75	74·97	31·67	0·7	824	1,508
	1898-99	35,651,577	1,039,713	78,280	1,117,903	87·22	68·67	26·94	0·6	818	1,330
Bombay	1897-98	22,701,942	679,234	60,196	739,430	91·77	58·49	29·0	0·20	435	1,690
	1898-99	22,612,220	622,095	48,349	670,444	92·75	57·25	26·74	0·10	434	1,539
Coorg	1897-98	173,055	9,480	1,497	10,977	95·21	85·03	59·51	0·34	8	1,180
	1898-99	173,055	4,793	880	5,673	92·13	77·50	29·46	0·13	9	587
TOTAL	1897-98	226,681,691	7,186,888	618,065	7,804,953	93·91	64·44	31·53	0·72‡	—	—
	1898-99	226,807,817	6,913,977	583,602	7,497,579	94·02	63·71	30·30	0·26‡	—	—

* Refers to special Vaccination Establishment only. † Including tea gardens.
‡ Calculated on figures taken from Sanitary Reports.

Animal Vaccinations.—In every province bovine lymph, either fresh or preserved, was largely used ; in Madras, Burma, Assam, Berar, and Coorg exclusively, or almost exclusively.

In Madras the highest ratio of success was obtained with fresh calf lymph, but excellent results were obtained with both lanolinated and glycerinated lymph, the use of which throughout the Presidency is exhibited in the following statement :—

		Glycerinated Lymph. Number of cases.	Glycerinated Lymph. Percentage of success.	Lanolinated Lymph. Number of cases.	Lanolinated Lymph. Percentage of success.
In districts	Primary and secondary operations.	413,243	82·8	220,170	89·0
	Re-vaccinations.	15,742	70·4	12,111	68·4
Operations performed by dispensary staffs and medical subordinates.	Total cases...	9,258	80·1	15,213	75·1
Operations in municipalities.	Total cases...	25,500	91·2	50,205	91·3

In the preceding year higher percentages of success were uniformly obtained with glycerinated lymph than with lanolinated lymph ; but in 1898 the percentages resulting from the use of the latter were higher in primary operations in the districts and in municipalities.

In the Central provinces the manufacture of glycerinated lymph was not attended by success. In Assam, on the other hand, the product of the Shillong depôt was extraordinarily efficacious. The vaccine is pounded up with a mixture of glycerine and water "in the proportion of two parts of the solid matter, and one part each of glycerine and water, by weight." It is preserved in capillary tubes, which are sealed in the flame of a spirit-lamp. The Sanitary Commissioner, Colonel Carr-Calthrop, while admitting that this method of preservation is "troublesome, laborious, and more expensive than simple admixture with lanoline," claims for it that much less risk of contamination is involved in the use of a fresh capillary tube for each operation, than when operation after operation is performed from the same pot of lanolinated lymph.

Bengal.—During the official year 1898–99 the vaccination staff employed in Bengal, under the direction of the Sanitary Commissioner, comprised three Deputy Sanitary Commissioners, 48 Civil Surgeons, 206 native supervisors and five head vaccinators, the operators being 79 vaccinators paid by Government, 41 paid by District Boards, 241 employed by municipalities and at dispensaries, 3,362 licensed vaccinators and 1,134 apprentices. For the greater part of the year the department was worked at an extraordinary disadvantage, being without the services of the Deputy Sanitary Commissioners, as commissioned medical officers could not be spared from other duties ; so that each of the three vaccination circles was in charge of a commissioned officer for only two or three months.

The total number of operations performed throughout the province was 2,147,452, or 172,084 fewer than in 1897–98. The decrease was distributed over 35 districts and is attributed to several causes, the more important being the difficulty experienced by the licensed vaccinators in realising their fees, the plague inoculation scare, and the introduction of the practice of making six punctures, the two extra punctures being connected in some way in the mind of the masses with inoculation against plague. The practice of making six punctures has now been introduced into the province generally, and although very unpopular at first—so much so that a certain degree of relaxation of the rule had to be permitted,—opposition is gradually dying out.

The number of primary operations that succeeded was 2,045,384 as compared with 2,195,509 in 1897–98, but the degree of success claimed was somewhat greater, 97·99 per cent. against 97·87. This high ratio does not, however, represent the facts, for vaccinators are prone to include in the returns partial successes and even absolute failures as successful cases. The number of re-vaccinations performed during the year was 60,167—a decline of 16,276 from the total of the preceding year ; while the number of successful cases fell from 49,207 to 40,520. The percentage of success was, however, higher, 67·34 against 64·36 in 1897–98. The falling-off in the number of re-vaccinations is doubtless only temporary, for in the gradual increase in the number of these operations in recent years there is evidence that the people are beginning to appreciate the security afforded by the second operation. The rise in the ratio of success, which in 1898–99 was nearly twice as high as the average of the previous triennial period, is attributed by the local officers (*a*) to the operations being done at a sufficiently long interval after the primary vaccination to allow of the passing away of the effect of the latter, and (*b*) to the primary operation having been a failure or only a partial success.

Taking the number of infants born at 40 per 1,000 of the census population of 1891, 17·66 per cent. were protected during the year, against 17·8 in 1897–98 and 15·50 the mean of the three years 1894–95 to 1896–97.

The average number of operations performed by the vaccinators was considerably less than in 1897–98, the figure falling from 650 to 586.

The work of inspection was greatly hampered by the absence of the Deputy Sanitary Commissioners : in the Metropolitan and Eastern Bengal circles, no inspections were made by them at all ; in Northern Bengal only 1,366 ; and in Western Bengal 7,627. In only two districts, Dacca and Purnea, as compared with five in the preceding year, did the inspections made by Civil Surgeons exceed 10,000 ; in seven as compared with nine the numbers ranged from 5,000 to 10,000 ; while in four districts the numbers were below 1,000. The proportion of the total operations inspected by Civil Surgeons was 8·51 per cent. against 9·34 in 1897-98, and the percentages verified by District Inspectors and Sub-Inspectors fell from 40·76 and 67·44 to 39·70 and 67·81, respectively.

Direct calf-to-arm vaccination is gradually gaining ground; the primary operations in 1898-99 numbered 206,083, an increase of 31,082 over the figure for the previous year, which was 25,681 in advance of that for 1896-97. Re-vaccinations, however, numbered only 21,632, or 7,855, less than in the previous year.

Vaccination is progressing in Bengal, but there is still much opposition to it in some districts, particularly in Behar, in Puri, and in the Tributary States of Orissa. In certain of the districts Major Dyson despairs of any effective remedy short of the introduction of the Compulsory Vaccination Act. In Puri he considers that high caste Hindu operators paid by the District Board should be substituted for the licensed men; and he suggests the starting of a vaccination school at Cuttack where operators could be trained for Orissa and the Tributary States.

Assam.—The vaccination staff in Assam working under the general control of the Sanitary Commissioner and the District Civil Surgeons comprised 18 native inspectors, 183 paid and 29 licensed operators, with seven apprentices; and was supplemented by medical subordinates attached to dispensaries and private practitioners on Tea-garden estates.

The total number of operations performed by all agencies was 258,905, a considerable falling-off as compared with the total of either of the last two years. The decline was, however, limited to primary operations and to the work of the provincial staff, and occurred in the districts of Sylhet, Goalpara, Darrang, Nowgong and Sibsagar, and the Nagar Hills. In Sylhet, where the greatest decrease occurred, it is attributed to a very severe outbreak of malarial fever, a lowered birth-rate and high mortality among infants, and in Goalpara it is said that similar influences were at work, but in the other districts it is to be feared that lack of zeal among the staff was the principal factor involved.

The number of operations performed by the paid and licensed operators aggregated 232,419, of which 208,542 primary operations and 20,113 re-vaccinations were reported to be successful. The ratios of success claimed work out to 98·84 per cent. of the primary operations and 93·84 of the re-vaccinations; but the Sanitary Commissioner commenting on the primary operations writes:—"I am of opinion that the number of cases reported as successful is too high. Vaccinators seem to report, as successful, cases in which the smallest vesicle follows the operation, notwithstanding that no trace may be visible three months afterwards. From my personal inspections, I should think primary operations were probably satisfactory in 95 per cent., partially successful in 3 per cent., and failures in about 2 per cent." And regarding re-vaccinations "the percentage reported of successful re-vaccinations, *viz.*, 93·84, is suspiciously high, and is to my mind inconsistent with a very high percentage of thoroughly successful primary vaccinations."

Operators at dispensaries did not report quite such high percentages of success; of a total of 14,271 operations, 13,226 were successful primary vaccinations and 348 re-vaccinations succeeded, the percentages of success being respectively 95·24 and 90·63.

The Compulsory Vaccination Act remained in force in 11 towns, but the aggregate number of operations performed in them continued to fall; in 1898-99 the number was 3,021 against 3,487 in the preceding year, and 4,152 in 1896-97. Notices were served on defaulters in only seven of the towns; 26 prosecutions were conducted, but only four persons were punished.

Taking the number of successful operations performed by all agencies combined, 45·02 per thousand of the population were protected during the year against 49·61 in 1897-98, and 40·62, the average of the previous quinquennium. The number of infants protected was 50,389, or about 22·36 of a hypothetical birth-rate of 40 per 1,000. This ratio, although less than that estimated in the preceding year, 25·9, is higher than the mean of the previous three years, which was 19·69 per 1,000. Although the actual number of cases inspected by Civil Surgeons was less than in the preceding year, 22,577 against 24,207, the percentage, owing to the smaller total, was higher, 9·15 against 8·87. Native Inspectors verified only 133,681 cases or 54·19 per cent., against 150,005, or 55·0 per cent. in 1897-98, the falling off being most conspicuous in Sylhet, Goalpara, and Nowgong, although in the last named small-pox was prevalent.

The percentages of the cases verified by Civil Surgeons and Native Inspectors which were found to be successful were, respectively, 95·99 and 98·73 per cent., as compared with 98·66 and 98·14 in the preceding year.

Inoculation is said to be practised in the districts of Sibsagar, Sylhet and Cachar, but not to the same extent as formerly, and no outbreak of small-pox was traced to it.

The animal vaccine depôt at Shillong was worked very successfully throughout the year, the supply from it was the largest on record and the quality of the glycerinated

lymph was all that could be desired, so that the Chief Commissioner has authorised the abandonment of further attempts to introduce the use of fresh calf lymph at district head-quarters.

North-Western Provinces and Oudh.—The supervising staff of the Vaccination Department in the North-Western Provinces and Oudh in 1898-99 consisted of the Sanitary Commissioner and his two Deputies, the District Civil Surgeons and 49 Assistant Superintendents. The average number of operators, including those paid from local funds, was 875, or nine more than in the preceding year.

The number of operations performed was 1,398,684, which, although it exceeded the total of 1897-98 by 14,024, fell short of that of 1896-97 by no less than 128,624.

The decrease was chiefly due to the employment, on duty in connection with plague prevention and the sanitation of fairs, of many of the most tactful and experienced vaccinators, the men engaged to take their places being, in many instances, untrained, and lacking the influence of the permanent employés.

The average number of operations performed by each vaccinator was almost the same as in the preceding year, 1,598·5 as compared with 1,598·9. Of the total number of vaccinations performed. 1,340,036 were primary, and 58,648 were re-vaccinations, and the percentages of success claimed were 94·96 and 79·76 respectively, against 93·74 and 68·20 in 1897-98. At dispensaries, 525 primary operations and 17 re-vaccinations were performed, the ratios of success being 90·02 and 71·43 per cent. There were 637,472 infants successfully vaccinated during the year, so that estimating the number of births at 40 per thousand of the census population, 33·80 per cent. of the children born were protected, as compared with 29·23 per cent. in 1897-98, and 30·24 the mean of the three years, 1894-95 to 1896-97.

The decline in the numbers vaccinated in the towns where the Act is in force was noted in last year's report. This year the results were still worse. Although a few more vaccinators were employed, the number of primary operations fell from 111,585 in 1897-98 to 110,515, and the re-vaccinations from 4,987 to 3,896; but there was some improvement in the quality of the work, primary cases succeeding in 1898-99 at the rate of 95·01 per cent. against 92·45, and re-vaccinations at the rate of 71·97 per cent. against 71·41.

Although one of the Deputy Sanitary Commissioners was absent, and much of the time ordinarily devoted by the other to the work of inspection was spent on duty in connection with the prevention of plague and at the great fairs, there was an increase in the number of inspections made by Deputy Sanitary Commissioners and Civil Surgeons, the percentage of the total number of operations verified rising from 6·31 in 1897-98 to 9·25; while Assistant Superintendents verified 29·40 against 26·98 per cent. Superior inspecting officers found 93·62 per cent., and inferior inspecting officers 93·38 per cent. of the cases seen by them to be successful, against 94·36 per cent. of success claimed by the vaccinators.

The supplies of lymph sent from Garhwal and Almora for starting work on the plains was of good quality, but many of the tubes sent from Tehri-Garhwal were bad, and had to be destroyed. The work done at the Lucknow depôt was satisfactory, but the same could not be said of the establishment at Allahabad.

Punjab.—In the Punjab the supervising staff, consisting of the Sanitary Commissioner, his Deputy, the District Civil Surgeons, six Divisional Inspectors, and 34 Native Supervisors remained unchanged, and the number of vaccinators was 303 against 305 in 1897-98. The number of operations performed during the year was 840,868, against 845,491 in the preceding year, and 902,413 in 1896·97. Of the total, 661,937 were primary operations and 178,931 were re-vaccinations, as compared with 631,774 and 213,717 respectively in the preceding year.

Excepting an increase, amounting to 41,117, in the number of primary operations performed by the district staff, there was a general falling off in the numbers of operations of both classes performed by all agencies. Among the causes of the decrease are said to be the failure of the vaseline lymph, difficulty in procuring calves, dislike of the vaccinators to the new system of working in groups, and carelessness on the part of the operators. All these matters have the attention of the authorities, and it may be stated that the falling off is, in part, at any rate, believed to be apparent only, since the stricter supervision by the District Inspectors has checked the too common falsification of returns. The reduction in the amount of work was most marked in the case of the special staff who performed only 62,196 primary operations against 72,031 in the

previous year, while the re-vaccinations done by them fell from 31,104 to 14,742 ; and even the latter figure is suspected by the Deputy Sanitary Commissioner to be "in excess of the actual number of operations performed." The decline in the work of the special staff is mainly due to the absence of supervision, the Deputy Sanitary Commissioner having been on plague duty for a portion of the year, but there was misconduct on the part of one of the native supervisors and some of the vaccinators, while the assistance which should have been given by certain local authorities was withheld.

The average percentage of success was somewhat higher in primary operations and lower in re-vaccinations than in the previous year, the figures being 94·84 and 58·80 in 1898–99, and 94·40 and 60·77 in 1897–98.

Returns were furnished by seven of the eight large Native States which maintain their own vaccination establishments. There were 84,547 primary operations and 42,506 re-vaccinations performed in them, the ratios of success claimed being 95·40 and 49·60 per cent. Nearly three-fourths of the operations were performed in Patiala, but the results, both as regards quantity and quality, were not so good as in 1897–98.

Estimating the number of births at 40 per 1,000 of the census population, 59·97 per cent. of the infants born during the year were protected, as compared with 57·5 per cent. in 1897–98, and 58·25 per cent., the mean of the previous three years.

Civil Surgeons verified 6·54 per cent. of the primary cases and 3·38 per cent. of the re-vaccinations, against 8·66 and 2·25 per cent. in the previous year, native supervisors inspected 60·14 per cent. and 35·21 per cent., against 61·10 and 23·73 per cent., and Divisional Inspectors 17·81 per cent. and 15·29 per cent., against 17·94 and 25·85 per cent. The ratios of success found on inspection were in all cases higher than those claimed by the vaccinators, in consequence chiefly of the latter being required to return all operations, the results of which are unknown, as failures.

The Compulsory Act was introduced into the towns of Leiah and Gujranwala during the official year ; but in most of the 18 towns in which the Act has been in force for some years past the amount of work done was comparatively small.

The vaccines used were humanized lymph, fresh calf lymph, and calf lymph mixed with vaseline. Information in respect of the success obtained with the different vaccines in the province as a whole is not given in the provincial report ; but the results obtained by the special staff were the following :—in primary cases, humanized lymph was successful in 100 per cent., fresh calf lymph in 97·55 per cent., and vaseline vaccine in 96·14 ; in re-vaccinations humanized lymph produced successful results in 87·31 per cent. of the operations, fresh calf lymph in 73·42 per cent., and vaseline vaccine in 74·13 per cent.

The depôts at Murree and Amritsar were open, respectively, from April to October, and from November to March. Only vaseline lymph paste is prepared at these depôts, and during the year 1,374 tubes were sent out from Murree and 1,792 from Amritsar. Of the total number only 53 are reported to have failed, but the results obtained with 744 are unknown

Central Provinces.—In 1898–99, as in the preceding year, the supervising staff under the control of the Sanitary Commissioner comprised the District Civil Surgeons, 28 Native Superintendents and 274 vaccinators.

With the passing away of famine, and the low birth-rate and high infantile mortality which attended it, the work of the department has improved. The total number of operations amounted to 435,174, against 384,476 in 1897–98, and the average number of operations performed by each vaccinator rose from 1,391 to 1,588. The increase was shared by the British districts and by the Native States, although in the latter re-vaccinations were somewhat fewer than in the preceding year.

In British territory the total number of primary operations was 294,289, of which 284,926, or 96·82 per cent., succeeded, and the number of re-vaccinations was 52,274 in which success was claimed in 41,377 cases, or 79·15 per cent., against 96·73 and 85·84 per cent in 1897–98.

In the Feudatory States primary operations aggregated 76,743 and re-vaccinations 11,868, the percentages of success reported being 92·86 and 95·70, respectively, as compared with 96·86 and 94·27 in the preceding year.

Besides these operations, there were in all 14,076 performed by the staff of dispensaries, or 147 less than in 1897–98. In the British districts 10,928 primary operations were performed and 1,411 re-vaccinations, the ratios of success being 94·03 and 61·45 per cent., as compared with 95·46 and 77·48, respectively, in the previous year. In the Native States there were 1,673 primary vaccinations and 64 re vaccinations, of which 91·51 and

87·50 per cent., respectively, proved successful, as compared with 90·86 and 91·38 in 1897–98.

Calculated on an estimated birth-rate of 40 per 1,000 of the census population, 44·61 per cent. of the children born during the year were protected, against 36·20 in 1897–98 and 50·29, the mean of the previous triennium.

Although in both British territory and in the Feudatory States the numbers of villages visited and operations verified by Civil Surgeons and Native Superintendents were larger than in 1897–98, yet, owing to the greater number of operations performed, the proportions seen by both classes of officers were less, falling from 18·79 and 55·45 per cent., respectively, to 17·19 and 53·35 per cent. The percentages of all cases examined by Civil Surgeons and Native Superintendents which were found to be successful were, respectively, 89·08 and 92·19, as compared with 92·40 and 93·45 in the preceding year, these figures being lower in both years than the percentages claimed by the operators.

Operations were carried on with humanized lymph, fresh calf lymph and calf lymph mixed with lanoline and with glycerine, but no figures to show the degree of success obtained with the different vaccines are given in the provincial report. It is, however, stated that the manufacture of glycerinated lymph was not at all successful.

Berar.—The provincial vaccination staff consisted of 7 Native Superintendents and 44 vaccinators, under the direct control of the Sanitary Commissioner.

The total number of operations performed was 132,903, of which 94,032 were primary and 38,871 re-vaccinations, as compared with 95,048 primary operations and 30,241 re-vaccinations, in 1897–98. The falling off in the number of primary operations was mainly due to the diminished birth-rate of the year, while the increase in re-vaccination was brought about by the special attention given to the operation in places where small-pox had broken out, and was attacking chiefly "the grown up children and adults for want of re-vaccination."

The average number of operations performed by each vaccinator, which in 1897–98 was 2,847, in 1898–99 reached the high figure of 3,020.

Of the primary operations 91,286, and of the re-vaccinations 8,989 succeeded, the percentages being, respectively, 97·1 and 23·1, as compared with 96·4 and 30·0 in the previous year.

Estimating the number of children born during the year at 40 per 1,000 of the census population, 60·31 per cent. of them were protected, against 63·4 in the preceding year, and 60·8 per cent., the mean of the previous three years. In the municipal towns where vaccination is compulsory, the percentage protected of the estimated number of infants born was 71·37.

About 2·06 per cent. of the primary operations were verified by the Sanitary Commissioner, and 55·6 per cent. by Native Superintendents, the percentages of success found by them being, respectively, 97·4 and 94·6, against 97·1 reported by the vaccinators.

Operations were started by the vaccination with lanoline lymph of children in each municipal town and district; when a good result was obtained calves were inoculated and distributed, one to each vaccinator, throughout the district, where the supply of fresh calf lymph was maintained during the season.

Madras.—The work of vaccination was carried on in Madras under the general supervision of the Sanitary Commissioner, by the Deputy Sanitary Commissioner with the assistance of the District Medical and Sanitary Officers and 61 Deputy Inspectors, with an average staff of 818 operators, or six fewer than in 1897–98. The total number of operations performed by them in 1898–99 was 1,105,084, against 1,258,010 in the previous year, the average number to the credit of each vaccinator falling from 1,508 to 1,330. Excepting the districts of Tanjore, Vizagapatam and Malabar, there was a decrease in all districts, which is attributed to a variety of causes, the more important being the plague inoculation scare, the absence of vaccinators, and the irregular supply of vaccine, to which may be added the absence on other duties of the Deputy Sanitary Commissioner, and the misconduct of not a few of the Deputy Inspectors.

The number of primary operations was 1,028,221, or 148,879 fewer than in the preceding year; and the number of re-vaccinations was 76,863, or 4,047 less than in 1897–98; the percentages of success claimed being, respectively, 89·6 and 75·5, as compared with 92·0 and 81·0 in the preceding year, and 92·6 and 80·2 in 1896–97. The apparent progressive decline in the percentage of success in primary cases is ascribed by the Deputy Sanitary Commissioner to recent figures being probably "a nearer approximation to the truth than those previously recorded."

By the staffs of dispensaries 12,909 operations were performed, or 810 less than in the preceding year. The percentage of success claimed in primary cases was 83·6, practically the same as in 1897–98, but in re-vaccinations it fell from 72·8 to 68·1.

Estimating the number of children born during the year at 40 per 1,000 of the population, the percentage of infants protected was 19·84, compared with 23·23 in 1897–98, and 22·0, the mean of the previous three years.

No inspections were made by the Deputy Sanitary Commissioner as he was engaged during the greater part of the year on duty in connection with plague. The percentage of inspections performed by Civil Surgeons and Native Superintendents, however, rose from 2·5 and 49·7 in 1897–98 to 3·0 and 56·7, the degree of success found by them being 86·0 and 87·7 per cent. of the cases seen against 88·7 claimed by the operators.

No humanized lymph was used, and operations were performed with fresh calf lymph, calf lymph preserved without admixture between glass plates, lanolinated lymph and glycerinated lymph. The following table shows the extent to which the various vaccines were used in the districts, excluding municipalities and dispensaries, and the degree of success obtained with each :—

—	Number of cases, primary operations and re-vaccinations.	Percentage of success.
Fresh lymph	229,439	97·6
Preserved lymph without admixture ...	100,690	95·9
Lanolinated lymph	232,281	88·0
Glycerinated lymph	428,985	82·4

As usual, the best results were obtained with fresh calf lymph ; lymph preserved without admixture comes next, then lanolinated lymph, and lastly glycerinated lymph. The improvement in the results obtained in 1898–99 with the lanolinated lymph, as compared with the previous year when the percentage was 86·6, is ascribed to full instructions regarding its use being issued to vaccinators, while it seems possible that the falling off in success with glycerinated lymph from 88·1 per cent. in 1897–98 was due to an inferior supply being sent out from the Cocanada depôt during a part of the year, but this is not fully brought out in the provincial report.

Coorg.—The vaccination department in the small province of Coorg was supervised by the Civil Surgeon, who had working under him a Native Inspector and eight vaccinators. The total number of operations performed was only 5,283, or rather less than half the total of the previous year. The cause of this extraordinary reduction was a plague inoculation scare excited among the people by the currency of an absurd rumour that anti-plague inoculation was being practised in the guise of vaccination. Of the operations performed, 4,554 were primary and 729 were re-vaccinations, the ratios of success being, respectively, 93·15 and 80·93 per cent. At the dispensaries 390 operations were performed, of which 72·80 per cent. of the 239 primary operations succeeded, and 60·93 of the re-vaccinations.

The percentage of infants protected was smaller than in any year since 1892-93, being only 7·38 of an estimated number equal to 40 per 1,000 of the census population.

The Civil Surgeon himself verified 7·95 per cent. of the operations against only 1·55 per cent. in the previous year, but the percentage verified by the Native Inspectors fell from 31·93 in 1897-98 to 10·95. Calf lymph was used exclusively.

Bombay.—Towards the end of 1898 the Native State of Cambay was "permitted to maintain a complete vaccination organization of its own," and the figures which, however, in 1898-99 relate to only 2,344 operations, have been separated from those of the Presidency proper.

The vaccination staff under the Sanitary Commissioner in Bombay and Sind, excluding Native States maintaining their own agencies, consisted in 1898-99 of five Deputy Sanitary Commissioners, one Superintendent of vaccination in Bombay City, 45 Superintendents of Sanitation and Vaccination, and an average of 434 vaccinators.

The number of operations performed by them was 668,529, or 67,880 less than in the preceding year, excluding the returns for Cambay, while the number of operations performed by each vaccinator fell from 1,690 to 1,539. The decrease occurred in both classes of operations, and was general throughout the Presidency, except in Bombay City, where there was a trifling increase.

In explanation the Sanitary Commissioner writes :—

"As in 1897-98, the year under report was a disastrous one for vaccination work. Firstly, there was during the later months of 1897 and early ones of 1898 a very low birth-rate and a very high death-rate, especially among children; during 1898 the former was very pronounced, and it was not until August that much improvement took place; then, there was still a certain amount of famine in some parts, and some other parts had not completely recovered from it. The plague was with us all the year and greatly interfered with work, so much so in some parts that vaccination had to be entirely stopped; nearly all the Deputy Sanitary Commissioners were on deputation, or leave, or on plague duty, and as no full-time officers were appointed their districts received very little of that inspection and supervision which is so very necessary in order to obtain efficient work; and lastly, several of the inspectors and vaccinators were on plague duty."

Of the total number of operations, 621,097* were primary and 92·86 per cent. of them succeeded, as compared with 91·90 in 1897-98. The number of re-vaccinations was 47·432, of which 56·97 per cent. were successful, as compared with 58·41 in the previous year.

Besides these, 1,915 operations were performed by the staff of dispensaries, of which 953 primary operations and 659 re-vaccinations, or 96·75 and 71·86 per cent. respectively were successful.

Taking the total births at the rate of 40 per 1,000, 49·91 per cent. of the children born were protected, against 55·54 in 1897-98, and 58·11, the mean of the previous three years.

Small-pox was very prevalent in Southern Arabia, and an additional vaccinator was engaged in Aden, while a vaccinator was sent to Lahej at the request of the Sultan of that place. The Arabs in the interior, it appears, are beginning to appreciate the benefit of vaccination, as many came to Aden to be operated upon, giving as their reason that "those who on former visits to Aden had been vaccinated were able to go about among the infected with impunity."

Owing to their absence on other duty but little inspection was done by Deputy Sanitary Commissioners, although that little, 2·32 per cent., was more than in the previous year, 1·18 per cent. Native inspecting officers, moreover, verified 40·68 per cent. of the cases against 31·79 in 1897-98.

Vaccination has hitherto been compulsory in the towns only of Bombay and Karachi, but in December, 1898, the Act was introduced into the town of Larkhana in Sind.

Inoculation was not practised anywhere except in the Nara Taluka of the Khairpur State, and measures have been taken to secure its discontinuance there.

Both humanized and calf lymph were used, the latter in Bombay City and in selected places.

On account of the non-receipt of returns from the Native State of Palanpur and the inclusion in the statistics of those from Cambay, the figures representing the number of operations in the Native States are not comparable with those of 1897-98. In the States of Baroda, Cutch, Kathiawar, Idar and Cambay, there was an aggregate of 192,895 primary vaccinations, of which 95·55 per cent. were successful, as compared with 94·90 per cent. in the preceding year. The number of re-vaccinations was 8,995, and 68·99 succeeded, against 67·22 in 1897-98. Nearly all the operations were performed on children,—153,049 infants were protected, and 30,341 children between one year and six years of age,—the total protection afforded being 28·23 per 1,000 of the population.

Burma.—The staff under the general supervision of the Sanitary Commissioner comprised the District Civil Surgeons, the Municipal Health Officers of Rangoon and Mandalay, and 12 Native Inspectors, with an average number of 177 vaccinators, or 10 more than in the preceding year. The number of operations performed by them was 466,308 against 421,786 in the preceding year, and 414,845 in 1896-97. Both classes of operations increased; the primary numbering 439,050 or 38,732 more than in 1897-98, and the re-vaccinations numbered 27,258 or 5,790 more than in the preceding year; but while the former increased in 30 of the 38 districts the latter increased in only 17.

* The grand total, 668,529, includes 779 secondary operations performed after the failure of the primary operations.

The causes of the improvement were the augmentation of establishment, the extension of the Act to four more municipalities, and the prevalence of small-pox in Rangoon and the districts in its vicinity.

Compulsory vaccination of immigrant coolies in Rangoon was stopped in August 1896, and the question of the introduction of an Act to legalise the compulsory vaccination of all unprotected adults is still pending.

Primary operations succeeded at the rate of 94·71 per cent. and re-vaccinations at the rate of 59·55 against 94·56 and 61·38 per cent. in the preceding year.

Dispensary vaccination continues to increase; the number of cases in 1896-97 was 8,403; in the following year it rose to 9,764, and in 1898-99 it has reached 14,349. Of these operations, 8,209 were primary, and 6,140 were re-vaccinations, the percentages of success reported being 88·66 and 62·70, respectively.

In all, 122,895 infants were protected, equal to 37·71 per 1,000 of the births estimated at 40 per 1,000 of the census population, as compared with 34·34 per cent. protected in 1897-98, and 24·15 per cent., the average of the previous three years.

In the Shan States only primary operations were performed. In the Northern States the number was 2,975 and the percentage of success 82·49; and in the Southern States the operations numbered 3,750, and succeeded at the rate of 86·80 per cent.

The proportions of the operations verified by Civil Surgeons and Native Superintendents were, respectively, 21·67 and 18·14 per cent., as compared with 22·58 and 16·52 per cent. in 1897-98, and they found 89·35 and 89·07 per cent. to have succeeded, against a percentage of 92·66 claimed by the vaccinators.

In Mandalay, Bassein, Moulmein and Akyab, locally prepared calf lymph was used, but the rest of the province obtained prepared vaccine from the depôts at Rangoon and Taunggyi. From the former depôt 16,979 grains of glycerinated lymph were supplied, of which the quality is stated to have been generally excellent. From Taunggyi 17,253 grains of lanolinated lymph were issued; up to the end of 1898 the quality was good, but later supplies were inferior.

Ajmer-Merwara.—In the British Territory of Ajmer-Merwara the work of vaccination was supervised by the Civil Surgeon of Ajmer aided by a Native Superintendent. The number of operators in 1898-99, as in the preceding year, was 13. The number of operations was 17,948, of which all but 132 were primary, as compared with a total of 16,555, including 75 re-vaccinations in 1897-98. The percentage of success reported was 98·46 in primary cases, or slightly less than in the preceding year, when 98·74 per cent. succeeded, but re-vaccinations were more successful, 65·15 per cent. against 61·33.

Estimating the children born at 40 per 1,000 of the population, 55·34 per cent. were protected during the year against 51·3 per cent. in 1897-98, and an average of 46·04 in the three years ending with 1896-97.

The Civil Surgeon inspected 881, and the Native Superintendent 8,225 cases, and found, respectively, 98·59 and 98·84 per cent. successful against 98·21 per cent. reported as successes by the operators.

Civil Sanitary Works.

Bengal.—During the official year 1897–98, the number of municipal towns in Bengal, excluding Calcutta, was raised from 148 to 151 by the constitution as municipalities of the towns of Asansol, Chandpur and Samastipur. The total income, including opening balances which aggregated £2,134 less than in the preceding year, was £284,332 or £5,634 less than in 1896–97, the falling off being much more than accounted for by the smaller opening balance and by a reduction of £16,367 in the amount borrowed. Of the total income 45·75 per cent., about 1 per cent. less than in the previous year, was devoted to sanitation; 9·84 per cent. was spent on roads; 6·60 per cent. on measures for the preservation of the public safety, and 28·39 per cent. on other requirements. The expenditure on water-supply shows a large decrease, from £36,332 in 1896–97 to £17,511, explained by reductions in capital expenditure of sums of £16,267 and £4,800 on account of the water-works at Bhagalpur and Howrah, respectively. The expenditure on conservancy was £70,588, or £9,154 more than in the previous year, the increase being due to precautions taken through fear of plague. The expenditure on drainage was £7,564, or £507 less than in the preceding year; and the expenditure on markets and slaughter-houses was £2,922 or £1,858

more, mainly on account of the construction of a municipal slaughter-house at Narainganj, and of improvements to the bazaar buildings at Darjeeling.

The average proportion of municipal income applied to original sanitary works, which declined from 5·03 per cent. in 1895–96 to 3·70 per cent. in the year following, fell to 3·57 per cent. in 1897–98. In only fifteen towns, including Bhagalpur (18·10), Sirajganj (17·18), and Birnagar (16·40), was more than 10 per cent. of all income spent in this way; and in no less than 41 towns, against 37 and 28 respectively in the two preceding years, nothing whatever was spent. On the other hand, there was again a rise in the proportion of income spent upon annually recurring sanitary works, from 40·20 per cent. in 1896–97 to 41·73 per cent., the proportions shewing the wide range from 70·53 per cent. in Faridpur to 7·93 per cent. in Joynagar, a small municipal town in the 24-Parganas.

The expenditure of public funds on rural sanitation was £21,565 against £26,685 in 1896–97; while private individuals provided £32,388 as compared with £78,138 in the previous year, when it must be remembered the purse strings of the benevolent were loosened in the presence of famine.

The most important sanitary work carried out during the year was the completion of a portion of the Champanagar and Nathnagar extension of the Bhagalpur water-works at a cost of £1,782.

The constitution of the Sanitary Board remained unchanged, and, as in former years, inconvenience arising from the difficulty in arranging for meetings was met by the circulation to the members of papers regarding the cases under consideration. The principal matters considered at the single meeting which was held were—

(1) The Monghyr drainage scheme; and
(2) The supply of filtered water to the towns on the right bank of the Hooghly.

The following are the more important projects for which preliminary estimates were prepared:—

(1) Alternative projects, eight in number, varying in cost from 24 to 35 lakhs of rupees (£160,000 to £233,300), for the supply of filtered water to the municipal towns on the right bank of the Hooghly. These were submitted to Government.
(2) The Patna water-supply. As stated in last year's report, it has been ascertained that an abundant supply of pure water can be obtained from the old bed of the river Sone, and as all the information necessary for the preparation of a scheme was received, the work was taken in hand.

Detailed estimates in connection with the following were prepared:—

(1) The flushing of some of the drains of the Patna Municipality pending the introduction of the water-supply scheme.
(2) The re-modelling of the intake of the Berhampore water-supply works.

Estimates and plans for the following projects were considered:—

(1) A scheme for the drainage of the town of Krishnagar by opening out the Anjana *khal*.
(2) A scheme for the drainage of Monghyr. The Board, while approving of the details of the drainage scheme, were of opinion that the introduction of a supply of water should precede its execution, and recommended the municipality to endeavour to introduce the water-supply scheme in combination with the drainage scheme; but Government, considering that the cost would press heavily upon the poorer tax-payers, have for the present declined to accord administrative sanction.
(3) Extension of the Howrah water-works. Scheme approved by the Board and sanctioned by Government.
(4) Re-excavation of Shiljoorie and Bijapur *khals* in connection with the drainage of the town of Comilla.
(5) Improvement of the drainage of Manicktolla. A surface-drainage scheme estimated to cost £3,330 was referred to the Board for opinion, but in the absence of details regarding levels, etc., had to be returned for re-submission with the necessary information.
(6) Extension of the unfiltered water-supply to the town and suburbs of Calcutta.
(7) Scheme for improving the Darjeeling water-supply system.
(8) Project for the construction of a municipal market at Narayanganj.
(9) Plans and estimates for lining the settling tanks of the Bhagalpur water-works with cement to prevent leakage were rejected, and a less expensive method by the use of fine sand was recommended.

(10) Dacca conservancy scheme. The Municipal Commissioners prepared two schemes—

(*a*) The sewage to be removed by carts from 30 depots to railway sidings and taken thence by rail to trenching grounds three miles away from the town—cost, £3,534.

(*b*) The sewage to be removed by carts to three new trenching grounds to be selected—cost, £2,000.

The Board supported the latter scheme (*b*) to Government.

(11) Drainage of the Siwan municipality.

(12) Remodelling of the intake of the Bhagalpur water-works. The existing intake readily gets choked with sand, and attempts to clear it are unsuccessful owing to the strong current flowing past the mouth of the pipe.

(13) A survey for drainage for the town of Nator was completed.

Numerous miscellaneous references were made by Government and by local authorities; the most important among the former was the question of bringing municipal water-works under effective control, and among the latter the passing of the tenders for the Howrah water-works extension.

In October the Board called for replies to a circular issued during the previous year to municipal committees and local officers regarding experiments on the biological treatment of sewage and waste liquids. From the replies received it seems that in only 30 municipalities were experiments made, but these were mostly successful. In this connection it may be noted that the Sanitary Engineer was placed on temporary duty in England with a view to his making himself acquainted with the more recent methods of sewage disposal. On his return to Bengal he published a brochure* on the recent methods of sewage disposal, which, under the orders of the Board, has been widely distributed in Bengal for the information of those concerned.

Assam.—The total income of the municipalities, stations, unions, and towns in Assam in 1898 was £17,323, as compared with £17,212 in the previous year; and of the total 45·52 per cent. was spent on sanitary works proper, against 43·98 per cent. in 1897. By far the largest percentage of income devoted to sanitation was 72·04 in Tezpur; elsewhere the percentages varied from 59·24 in Gauhati to 22·42 in Jorhat. No work of capital importance was undertaken during the year, nor, as indicated by the Chief Commissioner, is any large undertaking likely for many years to come in the small straggling towns of this province. In Gauhati, although £682 was spent on repairs to the pumping engine and other details connected with the water-works, the water-supply of the town is not yet in a satisfactory state, and the municipality have applied for a loan of £904 for further improvements. The Shillong station water-works suffered severely from the earthquake of 1897, and have not yet been completely repaired; £1,334 are required for the purpose, and steps to obtain funds have been taken. The water-supply of Sylhet was improved by sinking a well, and by the enclosure of tanks with barbed-wire fences. It is reported that the trenching of night-soil is not successful in the towns, as it has not been possible to get the land cropped; but as cultivators for such land can be found elsewhere, it is not clear why they cannot be found in Assam. Meanwhile, the incinerators at Silchar, Manipur, and Aijal are said to have worked well.

The sanitary works carried out in rural areas consisted chiefly in the construction and repair of wells, and the excavation and deepening of tanks. There were 35 Norton tube-wells sunk by the direction of the Barpeta local board and nine at the instance of the Gauhati board.

The use of village sanitary inspection books has been introduced into selected villages in each district, but so far with very little practical benefit.

No meeting of the Sanitary Board was held during the year, but the written opinions of the members were obtained on all sanitary questions of importance which were being considered.

North-Western Provinces and Oudh.—The constitution during the official year 1897-98 as a municipality of the town of Haldwani, in the Naini Tal district, raised the number of municipal towns to 104. Excluding opening balances, the total of the municipal income was £298,878, as compared with £276,859 in the preceding year. Except under the head of conservancy, upon which the sum expended rose from £62,562 to

* "Recent methods of sewage disposal in England, by A. E. Silk."

£66,009, there was a general reduction of the sums devoted to sanitary works; the expenditure on water-supply fell from £59,368 to £35,216; on drainage from £21,008 to £12,073, and on markets and slaughter-houses from £2,389 to £1,869; the aggregate expenditure reaching £115,165.

Except the further extension of the Allahabad water-supply to Karela Bagh, the remodelling of the Naini Tal water-supply and the completion of the Bhilaru sewage shoot at Mussoorie, no large work of importance was begun or completed, and the following notes have reference mainly to important works in operation, or in progress of completion.

At Agra, the daily average consumption of filtered water rose from 1,338,177 gallons in 1897-98 to 1,519,678 gallons, or 8·96 gallons per head of the population. In the cantonment the average daily consumption fell from 185,718 to 164,013 gallons. The additional filter, to the necessity for which allusion was made in last year's report, has not yet been supplied owing to financial difficulties, and, in the meantime, the total daily output of filtered water has been limited to $1\frac{1}{2}$ million gallons.

At Allahabad, the average daily consumption of filtered water was 1,410,229 gallons, equal to 8·04 gallons per head of the population. Improvements were effected at the intake which have removed the fear of the water-supply being diminished owing to the falling of the river in the hot weather, and have improved the quality of the water in the inlet well.

At Benares, there was an increase of $22\frac{1}{2}$ per cent. in the quantity of filtered water consumed, from an average of 1,905,216 gallons per diem to 2,336,084, or 11·04 gallons a head. The raised reservoir was completed during the year.

At Cawnpore, the daily average consumption of filtered water rose from 1,325,409 to 1,431,901 gallons, equal to $8\frac{3}{4}$ gallons a head.

At Lucknow, the average daily consumption in the city, civil lines, and cantonments was 978,982 gallons, or 3·7 gallons per head of the population; the maximum supplied in any one day being 6·2 gallons per head. In addition to the filtered supply, about 73 million gallons of unfiltered water were supplied to the Victoria Parks, for which it has been decided to have separate pumping machinery.

At Meerut, the average daily consumption was 406,235 gallons, or 3·4 gallons per head of the census population, but 6·2 gallons per head of the population reached by the supply.

At Mussoorie, the consumption of pumped water during the year was about 4,973,000 gallons.

At Naini Tal, the total quantity of water pumped was 10,681,500 gallons; but in addition to this the new springs tapped under the remodelling scheme yielded 6,000,000 gallons, and saved the cost of pumping for three months, while Rosamond's well springs yielded 2,102,500 gallons, and the gravity service to the Mall and Lower Bazar, 1,314,000 gallons. Thus, the total quantity distributed by pipes was nearly 32,000,000 gallons, or $8\frac{3}{4}$ gallons per head of the average population of 10,000.

An estimate, amounting to £17,000, for extending and remodelling the water-supply system was sanctioned in March, 1898; the pipes began to arrive in November, and before the end of the year were nearly all laid. The engines and boilers arrived in February, and though delay occurred, owing to parts of the boiler having been sent out incomplete, their erection was nearly finished by the end of the year.

At Rajpur and Dehra, the springs supplying the towns by gravitation yielded a good supply throughout the year, but no record of the quantity was maintained.

The water supplied to the towns was regularly analysed and generally found to be of excellent quality. At Agra, however, microbes resembling those associated with the causation of enteric fever were detected, and measures were taken to remove the defects which were supposed to lead to their presence in the water.

Less than half a lakh of rupees (about £3,330) was spent on the Benares sewage works during the year. Tenders were invited for the construction of sewers in the unsewered area, but the rates offered by the single firm that tendered were prohibitive, so it was decided to carry out the work departmentally. Subsequently, in accordance with the wishes of Government, it was decided to leave the unsewered area and deal first with the populous sewered area along the bank of the river. The design and details of the work gave rise to a good deal of discussion, and the project was not sanctioned until September, after which the plans and fittings had to be procured. This, and the difficulty in obtaining a supervising staff of sufficient experience, account for the small sum spent during the year.

The Bhilaru sewage shoot at Mussoorie was completed in July, 1898 ; but as the road from the bullock depot to the intake tank was not completed, the shoot was not used until October.

Surveys, with a view to introducing proper systems of surface drainage, were in progress or completed in the towns of Hathras, Aligarh, Fyzabad and Jhansi.

The Sanitary Board met three times at Naini Tal during the recess, and the following were the more important matters which engaged their attention :—

(1) The reports by the Sanitary Engineer on the quality of the municipal water-supplies. It was noted with satisfaction that the supplies were generally pure, and that the large reduction effected in the quantity of organic matter showed that careful attention had been paid to the filters. The board recommended that monthly qualitative bacteriological examinations should be made of the filtered water, and this recommendation has been accepted by Government.

(2) The sanitary condition of the town of Baghpat. The measures of improvement recommended by the Sanitary Commissioner and Sanitary Engineer were considered, and it was recognised that the finances of the municipality did not at present permit of any extensive drainage or water-supply scheme being carried out. Any funds the municipality can spare are to be devoted to improving the drainage and the sanitary condition of the town.

(3) The question of additional clerical establishment for Civil Surgeons was again discussed, and, after correspondence with Government, an extra clerk was sanctioned for the offices of Civil Surgeons at five of the larger towns.

(4) The reports on the working of the Village Sanitation Act were read, and it was noted that special attention was being given to the protection of the wells from contamination.

(5) A report by the Sanitary Engineer on a water-supply scheme for Jhansi was considered ; and it was agreed that although a supply from the river Betwa would be the best, and will perhaps ultimately be obtained, in the present state of the town's funds the proposed scheme to pump water from the existing cluster of wells would provide a safe and satisfactory supply.

(6) The insanitary state of the town of Kosi was discussed. The town was visited by the Deputy Sanitary Commissioner, and some of the remedies suggested by him having been adopted, there had been a satisfactory decline in the death-rate. The subsoil water of the town is very high, owing to the proximity of the Agra canal and of tanks which have no outlet for storm water ; but a drainage scheme to relieve the country in the neighbourhood of Kosi is being considered by Government.

Punjab.—The total income of the 31 municipal towns in the Punjab was, including the opening credit balance of nearly ten lakhs of rupees, £368,806, as compared with £353,064 in 1897. In spite of an increase to their funds, however, the aggregate expenditure on sanitation under all the most important heads declined ; the sum spent on water-supply was only £11,060, against £14,479 in the previous year ; the expenditure on sewerage and drainage fell from £6,857 to £6,463 ; and the expenditure on conservancy from £42,354 to £39,386 ; the total of all sanitary charges amounting to only £75,007, against £77,860 in the preceding year, and £82,446 in 1896.

The sum realized from the sale of street sweepings and manure, which in 1897 was £9,942, or about £867 more than in 1896, fell slightly in 1898, to £9,900 ; but a decline in the direct profit from this source is not to be regretted if, as in this case, it results from a safer method of filth disposal.

The principal sanitary works completed, in progress, or under consideration were the following :—At Simla, extensive improvements to the water-supply were in progress, some portions of the work being completed during the year. At Haripur, the water-supply project was completed at a total cost of £3,084. At Ludhiana, successful boring operations were carried out at the site where it is proposed to sink wells for the water-supply, the water found was of good quality, and an estimate for the construction of an experimental well was prepared. At Amritsar, the survey and preliminary operations in connection with the new water-supply of the town were completed.

At Lahore, the sewerage and drainage scheme for the city was in progress, as well as work on the Anarkali and Mozung outfall ; but the sewerage and drainage project for Anarkali was deferred for want of funds. At Multan and Rawalpindi beginnings have been made with drainage schemes ; but the drainage projects for Ferozepore City, Fazilka,

Jagraon, and Muktsar remained in the consultative stage, at least no money was spent on them, while the project for the diversion of the town drainage at Abbottabad was held in abeyance.

The sewerage farm in the neighbourhood of Delhi continues to be worked satisfactorily, in so far that the filth from eleven wards of the city is disposed of without nuisance, and the land is let out at a higher rate than was formerly the case.

Little progress is reported in the improvement of rural sanitation ; but efforts are being made to stimulate the interest of the rural population in the subject by the offer of rewards to the village in each tahsil which effects the most improvement in its sanitary condition, the point upon which stress is to be laid to be determined by the Sanitary Commissioner aided by the suggestions of the District Civil Surgeon.

No meeting of the Sanitary Board took place during the year, the reason given being that the members, feeling that the Board had no executive power, would meet uselessly. The question of extending the scope of the Board's work is being considered by the Local Government. During the year, papers relating to subjects of more or less importance connected with sanitation were circulated among the members.

Central Provinces.—The income of the nineteen *sadar* towns in the Central Provinces, which had fallen to £94,024 in 1897, recovered slightly to £95,467 in 1898; and the total expenditure on sanitation rose from £19,204 in the former year to £20,882 in the latter, including £5,275 on water-supply, against £4,096 in 1897, and £13,992 on conservancy, as compared with £13,580.

No new work of any magnitude was begun during the year ; but the water-supply works at Jubbulpore and Wardha were completed at a cost, respectively, of £16,512 and £14,876.

At Khandwa, further progress on the water-supply works was made ; and at Bhandara the works were completed, with the exception of the laying of the distribution pipes. At Harda, the water-supply project remains in abeyance apparently for want of funds.

The sum allotted for village sanitation was £6,428 ; but only £2,366 was spent, including £878 on the construction of wells, mostly in the districts of Sambulpur, Wardha, and Nagpur, and £67 on the construction of tanks in the Nagpur district. On site cleansing, £1,086 was spent, and on drainage and roads, £153.

Progress continues to be made in the record of sanitary progress in the villages ; and new sanitary maps, with lists of the villages included in them, have been prepared in order to start a new system of registration.

The constitution of the Sanitary Board remained unchanged, and a meeting was held at each divisional headquarters. As in former years, the principal business was the improvement of sanitary conditions in villages.

Berar.—The estimated income of the twelve municipal towns in Berar, in 1898, was £17,702, or about £134 less than in the previous year ; and the actual expenditure on sanitation was £8,984, as compared with £11,278. The decrease was distributed under all the principal headings ; the expenditure on water-supplies falling from £3,860 to £2,898 ; on conservancy, from £4,457 to £4,210 ; on drainage, from £706 to £196 ; and on miscellaneous works, from £2,254 to £1,682. The apparent falling off in the expenditure on drainage is greater, while that on conservancy is less, owing to the Sanitary Commissioner having transferred certain sums, formerly reckoned under the heading drainage, to the heading conservancy.

No new work of considerable magnitude was undertaken during the year.

The expenditure under the heading water-supply represents for the most part the repayment of loans ; but there was a great deal spent on pumping. Unfortunately the water-supply works at Akola and Amraoti have disappointed the expectations formed of their performances. At Akola, the failure of the rains and the great heat so lowered the water level in the wells at Kapsi and Majode that pumping had to be carried on for a longer time than usual, under unfavourable circumstances, and, unhappily, at an exceptionally high cost. At Amraoti, the Kalapani tank dried up, but fortunately a fairly good supply of water was discovered by Dr. Khote at the confluence of two nullahs near Rajapeth, where a well was sunk and water pumped for the supply of the town.

At most of the towns night-soil is trenched, but the trenches are not in all cases cropped. Street sweepings and household refuse are generally sold to contractors for brickmaking.

In the districts, the sum devoted to sanitation fell from £7,032 in 1897 to £5,170 in 1898, including £1,944 on water-supplies, and £2,600 on conservancy.

Village sanitary inspection books have been introduced in five selected villages in each district. The books are kept up by *taluka* officers not below the status of *tahsildar*, and are sent annually to the Civil Surgeon's Office, there transcribed, and returned to the village official. "The information so recorded," it is stated, "will be put to some practical use in future."

No information is given by the Sanitary Commissioner about the proceedings of the Sanitary Board.

Madras.—Excluding the presidency town, the estimated income of the fifty-eight municipal towns in Madras, in the official year 1898–99, was £197,082, as compared with £215,208 in the preceding year. The allotment for sanitary purposes was £104,770, or 53·2 per cent. of the total, against 63·6 per cent. in 1897–98. The actual sums expended during the nine months ending with December, 1898, were, except in the case of conservancy, much less than in the corresponding period in 1897; on water-supply, only £8,022, against £27,140; on the improvement of sites, £10,136, against £10,890; on miscellaneous sanitary improvements, including the repair of tanks, £3,912, against £5,282; but on conservancy, the sum rose from £30,924 to £33,212. The decline in expenditure is explained by the husbanding, by municipal bodies, of their resources against a possible invasion of plague.

The municipal income of the city of Madras was £89,877, or about £6,500 less than in the preceding year, but £56,299 was set aside for sanitary purposes. The actual expenditure during the first nine months of the official year was £35,964, as compared with £30,356 in the corresponding period in 1897. The bulk of the expenditure was on conservancy, £19,734, and on miscellaneous improvements, £9,908, as compared with sums of £15,872 and £11,246 respectively in 1897. On water-supplies, the expenditure in 1898 was £887, against £194, and on site improvement £3,530, against £2,419.

At Conjeeveram, the construction of additional works, viz., the fencing in of the pumping station, the construction of a service reservoir, and the extension of the pipe service were nearly completed, the cost being met from savings effected on the original estimate for the water-supply works.

Surveys in connection with water-supply schemes were made at Berhampur, Bezwada, Chidambaram, Guntur, and Kumbakonam; and five water-supply projects for Bezwada, Kurnool (extension), Tanjore (extension), Tiruvannamalai, and Vizianagram, and one drainage project, Kumbakonam, were prepared and submitted either to Government or to the Sanitary Board.

At Bezwada, it is proposed to sink three infiltration wells in the bank of the Kistna, and to pump water from them through a twelve-inch main to a service reservoir situated on the highest land between the pumping station and the town, the water being distributed by gravitation to fountains in the town. The scheme will give 15 gallons per head daily to an estimated population of 30,000, and will cost £25,027.

At Kurnool, after the completion of the water-works, there remained a balance of nearly £400, which it is proposed to devote to an extension of the pipe supply.

At Tanjore, it is proposed to extend the works, at a cost of £1,800.

At Vizianagram, the proposal is to cut an infiltration gallery 1,700 feet long, parallel to, and about 1,000 feet from, the bank of the Ootaigedda, a perennial stream about a mile and a half to the north of the town. The water will be pumped from the gallery to a service reservoir at a sufficient elevation on an adjoining hill, and will thence be distributed in pipes by gravitation. The project provides for 15 gallons *per diem* per head to a population of 40,000, and is estimated to cost £18,800.

There has been no advance made in sewage farming, which was carried on at Madras, Erode, Tanjore, Anakapalle, and Vizagapatam. A plot of land was purchased for the purpose at Tinnevelly, but nothing further was done. The income derived from the sale of street sweepings, &c., continues to increase.

The estimated income of the district boards in 1897-98 was £530,847, and the sanitary allotment was 8·3 per cent. of the total, against 8·4 per cent. in each of the two preceding years. During the first nine months of the financial year £24,656 were spent, including £3,704 on water-supplies and £16,611 on conservancy. These sums show a considerable decline as compared with the previous year, due, it is stated, to routine sanitary improvements being put off on account of the demand for funds to meet the possible occurrence of plague.

Little progress, it seems, has been made in ordinary rural sanitation, but the Sanitary Commissioner has great hopes of the results of a revision of the Act for Local Fund areas, which is being made.

The constitution of the Sanitary Board remained unchanged, but the rules for the conduct of business were slightly modified by the addition of a rule making it incumbent on collectors to consult the Board when special difficulties, for which rules do not provide, arise in the laying out of house sites near railway stations. The Board scrutinised plans and estimates for 36 municipal and 78 local fund works, estimated to cost in the aggregate £32,636. Besides examining the various projects of which mention has already been made, proposals in connection with many other schemes, for which estimates had not been prepared, were considered by the Board.

Coorg.—The total expenditure on sanitary works in the small province of Coorg in 1898 appears to have been less than one hundred pounds, devoted chiefly to the construction of a new well at Gonikoppal, and to an improvement of tanks and of drains at Somwarpett.

The Sanitary Board met three times during the year, and the following was the principal business before them :—

(1) A suggestion made by the Civil Surgeon that each municipality should entertain one or two Sanitary Inspectors was considered a good one, and it was agreed that it should be brought before the town committees, but it was pointed out that as the towns are very poor it was doubtful if the necessary funds could be provided.

(2) The prevention of the invasion of plague from the neighbouring province of Mysore. The measures recommended were strengthening the medical inspecting staff, and strict attention to the sanitary condition of towns, villages, and coolie lines. Measures were adopted for the engagement of a plague supervisor and five plague inspectors, and a simple set of instructions for disinfection was drawn up and copies circulated among the inhabitants.

(3) A plan for a hospital at Pollibetta was approved.

Bombay.—The number of municipalities in Bombay in 1898, excluding Bombay City, was 166, or one less than in the previous year, two municipalities, Matar, in Kaira, and Pussesavli, in Satara, having been abolished, and only one new municipality, Kharda, in Ahmednagar, having been established. The aggregate income in 1897-98 was £355,080, a decrease as compared with the preceding year of a sum not far short of £40,000. Not only was the income less, but the proportion allotted to sanitation showed a large decline, from 57·21 to 49·23 per cent. of the total. The actual sums expended were, on water-supply, £34,534, against £60,527 in the previous year ; on conservancy, £70,051, against £98,507, and on improvement of sites, £8,129, against £11,406. The expenditure on miscellaneous sanitary work, including the construction and repair of tanks, was nearly trebled, rising from £15,890 to £44,177.

It is stated by the Sanitary Board that, owing to the heavy expenditure in connection with plague, the consideration of important sanitary improvements has been deferred in almost every municipality, and that unless Government come to their aid in relieving them of some portion of the debts contracted, sanitary work must be at a standstill for years.

At Shikarpur nothing was done to drain the town, and indeed the municipality has passed a resolution stopping the construction of a system of gutters, which would have removed some of the waste water from the town.

At Sukkur the water-works engines have been neglected, so that extensive repairs will soon be necessary.

At Sholapur the municipality still rely upon one engine to pump water, and, should it break down, the results will be serious.

At Satara, it is stated that the Municipal Commissioners consider it inconsistent with their dignity to allow the Government Engineer to supervise the miles of open channel from the Kas tank, although they are quite unable to supervise it themselves.

At Hyderabad, the municipality was induced to order new engines for the river pumping station ; and plans and estimates for completing the water-supply project have been prepared. The committee obtained plans and estimates for a satisfactory drainage system, but the scheme has been shelved.

At Ahmedabad, the plans for the remainder of the drainage scheme have required some modification, but the municipality has applied for permission to raise a loan of eight lakhs (£53,334) of rupees to carry out the work

At Kaira, a new water-supply scheme, to cost £5,334, has been sketched out.

At Yeola, there is great delay in carrying out the water-supply scheme, due, seemingly, to delay in receipt of the necessary materials.

At Ahmednagar, the water-supply question is becoming acute. The town is situated upon a high table-land subject to recurring deficiency in the rainfall. Not only is the rainfall precarious, but, for some reason, the level of the subsoil water has been steadily falling for the last ten or fifteen years ; this affects the wells of course, and also the old aqueducts upon which the town relies for its supply of water. The only solution of the question, it is said, is the completion of the Kapurwadi tank, at a cost of about £10,000.

At Kirkee, the water-supply project has been nearly completed.

At Poona, the Sanitary Engineer has been directed by Government to prepare comprehensive drainage schemes for the city and for the adjoining crowded *sadar* and Sholapur bazars.

At Akalkot, the water-supply project, which is being carried out under the supervision of the Sanitary Board, was rapidly approaching completion ; and it was hoped that the engine would be at work within less than a year of the date when final sanction to the scheme was accorded.

Like the municipalities, the district boards suffered a decline of their income, which fell from £276,384 in 1896-97 to £256,146 in 1897-98. The sanitary allotment was reduced from £57,604 to £47,479, of which £41,901 was set aside for, and £27,662 actually spent upon, water-supplies.

The Village Sanitation Act was introduced into 17 more villages, making 299 in all ; while village sanitary inspection books are in use in 3,199 villages, although, owing to the disorganization of ordinary sanitary work in the face of plague, but little progress has been made in filling them up.

The constitution of the Sanitary Board remained unchanged. The number of meetings is not stated, but the members are apparently in continuous communication with each other, and much useful work was done by them during the year, to some of which, and the most important, allusion has been made above. The Board again approached their Government with a view to having executive powers conferred on them, but the Government of Bombay are not at present prepared to alter the rules governing their duties and powers.

Burma.—The income of the towns and districts in Upper and Lower Burma in 1898 was £451,766, and nearly 33 per cent. of this, or £148,027, was spent on sanitary improvement of one kind or another ; although, as pointed out by the Sanitary Commissioner, many of the other "sanitary works," which absorbed £54,216, have a very indirect bearing on sanitation. The sum expended under this heading is, however, more than £10,000 less than in 1897, while the expenditure on water-supply has increased from £16,076 to £26,056, and that on drainage from £7,987 to £27,255. On conservancy the expenditure fell from £54,154 to £40,508.

No sanitary undertaking of capital importance was begun during 1898, but the newly appointed Sanitary Engineer took up his office in January, and was very fully occupied throughout the year. A survey for water-supply works at Moulmein was completed, and plans for a gravitation project, estimated to cost £57,618, were submitted to the Chief Engineer. A preliminary survey was made of Bassein, and a report was made on the Kanthaonzin lake project for its water-supply. Mandalay and Meiktila were visited, and reports on their water-supplies submitted ; a project for the water-supply of Meiktila, at a cost of £8,829, being reviewed. The project prepared by the Executive Engineer of the Southern Shan States for the water-supply of Kengtung was thoroughly examined, and returned with suggestions for revision.

The plans and estimates prepared by the Municipal Engineer for the Prome drainage scheme were examined and returned for revision.

Village sanitation seems to make progress in some places, but in others the matter does not receive the attention from the district officials that its importance deserves.

"The Sanitary Board did practically no work during the year."

General Remarks.

The Red Sea Pilgrim Traffic.—The number of pilgrims who arrived at the Camaran quarantine station during the winter and spring of 1897-98, and who were there detained for observation prior to proceeding to Jeddah for Mecca for the Haj of the year under review, was 15,228, against 14,210 in 1897. Of the total, only 1,014 were registered as coming from Indian ports, *viz.*, 890 natives of India and 124 Afghans, while in 1897 these numbers were, respectively, 2,493 and 327.

As regards India, the way to the Hejaz was practically closed during 1898, by the prohibition issued by the Government of India on February 20th, 1897, which suspended the pilgrimage for that year; but this order was subsequently modified in a Notification (November 20th, 1897) by the same authority, to the extent of permitting persons, not being permanent or temporary residents of the Bombay Presidency, excluding Sind, to embark at Karachi or Chittagong, the necessary precautions being taken for the preliminary medical observation of the intending pilgrims. At the same time the Government advised all concerned to refrain from taking advantage of the concession, in view of the stringent quarantine regulations imposed by the Turkish Government, and the consequent inconvenience thereby entailed on Indian pilgrims on arrival in Arabia. A quarantine camp was accordingly established at Chittagong, and 730 pilgrims, who arrived for embarkation, were there detained for observation, and of these 708 were ultimately allowed to proceed on board the s.s. "Jubeda," which left that port on February 16th. Subsequently, on November 10th, 1898, the Government of India further ordained that no person resident in the Bombay Presidency (excluding Sind, but including its port, Karachi), the Madras Presidency, Mysore, the Hyderabad States, and Coorg, would be permitted to embark for Mecca from any port in India, save Chittagong, and then only after a period of detention for medical observation. Intending pilgrims were, at the same time, again advised to defer their journey until a more favourable season.

As subsidiary measures, and prior to the order last noted, special arrangements were made to ensure that pilgrims passing through Baluchistan should be conveyed by train, in reserved carriages, to observation camps before they were permitted to embark from Karachi; and further, authority was given to the Bombay Government to issue any necessary orders under the Epidemic Diseases Act in connection with the arrival of pilgrims from the Madras Presidency, who would be likely to require transhipment at Bombay *en route* to Karachi.

As regards Bombay, no vessels with pilgrims for Mecca left the port during the year, and from only one port in the Madras Presidency, *viz.*, Malabar, was a ship despatched, and this vessel left on March 8th, carrying 207 pilgrims. So far then as can be accurately ascertained, only two ships left Indian ports in this traffic, the total number of pilgrims conveyed being 915. It is satisfactory to record that no case of cholera or plague occurred during the outward or homeward voyages, nor at Camaran, where Indian pilgrims were detained for ten days prior to their departure for Jeddah.

Return of the Pilgrims.—During the year 1,342 pilgrims returned from the Haj to Bombay *viâ* Aden and other ports, and these were conveyed in six ships, which made altogether eleven trips between and including the months of April and November. In order to obviate the danger apprehended from the mixing of the pilgrims with the towns-people, the arrangements which had been successfully carried out in 1897 were again resorted to. The pilgrims were not allowed to enter the town, but after disinfection of their effects, were sent direct from the ship to the railway station, and thence, by batches, in special trains to their destinations, the local authorities concerned being advised of the despatch of each train.

During the return voyage, five cases of infectious disease were recorded, all of small-pox; in all six deaths occurred: four from chronic dysentery, one from small-pox, and one suicide. At no other port in India were returning pilgrims disembarked.

As regards the health of the pilgrims, the arrangements made for their control and comfort at Jeddah and on the journey thence to Mecca and back, nothing can be recorded here, as the usual report has not been submitted.

Jigger.—The expansion of the Empire, and the development of inter-communication of its component parts, has had for one of its consequences the risk of affording an open door to the invasion of India by the Chigger or "Jigger" pest. The Jigger (*Pulex*

Penetrans) is indigenous to South America and the West Indies, but obtained a foothold on the West Coast of Africa early in the "seventies," where it is said to have been landed in sand ballast from a ship from Brazil. Its gradual spread from the coast was slow at first, and confined to the dry sandy tracts, but as the interior was opened up by the several expeditions of explorers and traders, the jigger was carried more rapidly throughout Central Africa, traversing the whole breadth of the continent in the lines of the trade routes. Extended references to its distribution and clinical effects in Central Africa will be found in the accounts recently published by travellers in this region, and their statements are amplified and independently confirmed by Captain Haig, I.M.S., the medical officer in charge of the 1st Battalion Uganda Regiment. In an interesting note on the subject, after describing the insect and the conditions which favour its existence outside the body, the clinical symptoms and course, and the ultimate disability that often follows the access of the impregnated female to the vascular layer of the skin, Captain Haig lays stress on the following points, which have an epidemiological interest.

After referring to the well-accredited assertion that the pest, originally confined to South America, was conveyed thence by a ship to the West Coast of Africa, the fomites in this case being sand ballast, which was discharged at the port of arrival, he notes its early confinement to the dry sandy tracts, with very slow and gradual dispersion. With the opening-up of the interior by explorers and traders, there was an extraordinary dispersion of the pest, its progress being easily traced as *pari passu* with the advance of the various lines of communication, until from the lakes to the coast on both sides it now swarms over Equatorial Africa. But with this there is an apparent confinement to a certain restricted zone, roughly equatorial in general, but locally dependent on the drier and more sandy soils. It remains to be seen what effect the extension of communications north and south will have on its dispersion. "They cannot withstand moisture, and sprinkling the floor of a house with water drives them away."

While chiefly dependent on human hosts for progress to pastures new, and to some extent for propagation (though many of the lower animals serve this purpose, and some warm-blooded animal seems to be essential for the period of gestation of the female), yet the insects appear to be able to survive for a considerable but undetermined period away from the neighbourhood of men or animals. Captain Haig further lays stress on the great value of habits of personal care and cleanliness as affording the one effectual means of preventing its disabling effects. The necessity of daily routine examinations of the feet (and of other parts of the body which have been in contact with the ground, *e.g.*, the elbows and buttocks) is strongly insisted on, and an instructive contrast is drawn between the clean and intelligent people of Uganda and the Masai tribes, who are said to be dirty and savage, in respect of the almost entire immunity of the former to the ravages of the insect, while the latter suffer terribly for their neglect. "Numbers of these people (the Masai) die from blood poisoning, the result of jigger ulcers." Again, "the sepoys of the Uganda Regiment used to be laid up frequently owing to jiggers, but now that they have learnt to examine their feet regularly they do not suffer at all." In this way the penetration of the impregnated female is prevented, but at a later stage the excision of the gravid insect and its destruction by fire will obviate the propagation of the pest. Lastly, another observer, Captain Kilkelly, I.M.S., who was in charge of a native regiment returning from Mombassa to Bombay, *viâ* Aden, has found that a period of from two to three weeks is required, from the time of the entry of the pulex into the tissues to the approximate time of ovulation, a fact which should secure the detection of cases in passengers from the East Coast of Africa to any Indian port. That the pest can, however, be introduced into new territory widely separated by sea from its present habitat, by incorporation in a human host, is shown by recent experiences in Bombay, where patients coming from Africa have been admitted to hospital.

The foregoing has its general interest in the fact that we have here a picture of an endemic disease becoming epidemic in the sense of its spreading widely and attacking the majority of the inhabitants of large and widely separated areas, but apparently always under the limiting conditions of the life requirements of its cause, an instance of the truth that epidemiology is a branch of natural history. As regards the endemic areas, where the cause is one of the natural fauna, our safeguards lie in certain preventive measures; outside these areas, although the parasite may be introduced, its propagation and extension will depend on whether the environment be favourable or unfavourable to the requirements of what may be called the saprophytic stage of the organism.

India has long had constant and frequent communication with South America and the West Indies on account of the rice and coolie traffic, but there is no record of the introduction of the jigger by this means. More recently the connection of our West Coast

ports has become much closer with the East Coast of Africa, and it was owing to the reports of the widespread nature of the pest, and of the grave disabilities it inflicted, that the Government of India were moved to take precautions for the prevention of its introduction into this country. The Governments of Madras, Bombay, Bengal, and Burma were accordingly addressed upon the subject, and the adoption of the following precautions was ordered. Periodical inspection and careful treatment of all Indian coolies employed by Government in British East Africa or in other parts of the continent having direct communication with Indian ports; medical inspection of all persons leaving East African ports for India, and the prohibition of embarkation for India of those suffering from jigger; medical examination on board ship of passengers for India with the object of detecting cases infected shortly before embarkation, and which may have developed on the voyage; careful medical inspection at the port of debarkation in India of arrivals from Africa, and detention for treatment of all cases of jigger, in which the parasite had not already been extracted or destroyed. It was also arranged that advice should be given to natives in whom the parasite might develop after leaving Bombay and arrival at their homes, as to the nature of the disease and the necessity of early recourse to a dispensary for treatment. Where ships contained cases, washing down with kerosine oil was advised, and the ballast was to be discharged into the sea.

These precautions have so far been justified at each step, and the first alarm of a real danger to India of the introduction and dispersion of the jigger, though justifiable, was probably exaggerated. The timely warning received and the knowledge spread of the chief safeguards to be adopted, which may be summed up as personal care and cleanliness, have most probably secured us against one more scourge. But beyond this it is doubtful if the damp coast districts of India, to which the parasite would first be brought, are suited to the development of its larval stage; it is beyond doubt that jiggers must, previous to the warning of late in the year under review, have been carried into India by returning coolies or others, but, so far as is known, without establishing a foothold.

For the rest it appears probable that the great range of temperature, and the monsoon conditions to which the greater part of this country is liable, would prove inimical to its naturalization.

Disposal of excreta; the Sewage problem.—The effective removal and disposal of excreta in this country have ever been a standing problem for the sanitarian, and it is one that, in the very diverse circumstances under which the different communities live, affords little prospect of a final and comprehensive solution. Out of a total population of some 300,000,000 persons, 90 per cent. dwell on the land in villages, the majority of which can only be visited at long intervals by a sanitary authority, and where ignorance and primæval custom in these matters give consent to that individual freedom of action which prevailed anterior to the Mosaic code. Hindus maintain a high standard of personal cleanliness, but their ignorance and the trammels of custom make it very difficult to introduce sanitary improvements.

When we come to the towns and cities the difficulties and dangers are increased, for the native retains much of his ignorance, and clings to his customs, and what is effected by sanitary ordinance is but a more or less satisfactory compromise as far as removal of excreta is concerned, while the difficulties of disposal are greatly enhanced. This will be more clearly understood when the fact is grasped that, save in some half-dozen of the largest towns, no system of sewerage proper obtains, and the very general arrangement is for the night-soil to be removed by hand from the private dwelling and the public latrine, to spots set apart on the outskirts of the town, where it is commonly deposited in pits (from which it may or may not be removed after some months for use as manure), or it is trenched. Waste water (sullage) is dealt with separately; as a rule, it trickles out of the houses and is carried off by surface drains to discharge into "tanks" or a convenient "*nullah*," or to a river. This is a point of great importance in view of any scheme of disposal. The native population uses an extremely small quantity of water for all domestic purposes, for while the average consumption per head in large English towns is about 33 gallons daily, it is probable that the native of India finds all his needs supplied by one or two gallons (excluding that for his cattle). It will now be evident that sewage, as the term is used in Europe, does not and never will exist in India, except under very exceptional circumstances, in a few large cities, with a water-supply on modern lines, and in cantonments for British troops, when treated apart from any large native community in their neighbourhood. As Farr said, "a system of sewerage is the necessary complement of a water-supply"; in the absence of the latter, save that obtained from a number of disconnected wells, the former has found no place in

our plan of operations. Of recent years, however, the situation has been entirely changed in certain of the larger cities and towns by the introduction of that very factor, and we consequently find these more advanced communities face to face with the problems of disposal which have exercised English sanitarians during the last half century, or rather since the introduction of the water-closet in 1828-33. And it may be briefly stated that, in the search for a means of disposal, the sewered towns in India have followed the example set in England. Bombay endeavours to discharge its excretory refuse into the sea, as is the case with Rangoon, where the "Shone" system of removal has long been in satisfactory operation. In Ahmedabad and Karachi, after certain difficulties of detail had been met and overcome, broad irrigation, with subsequent cultivation, has been successfully carried out. The Calcutta sewage is conducted to an outfall into the Salt Lakes, five miles east of the city; that of Benares is discharged into the Ganges, while that of Simla finds its way into a mountain water-course.

In cantonments, the system of disposal varies according to the site and the available land. The night-soil is removed by hand or cart, or, in a few instances in some hill stations, by wire tramway, to a suitable site where it is deposited in pits, or is trenched. Here we see the "dry-earth" system under the most favourable conditions, but with results often not in proportion to the efforts put forth, and hence the resort, in many cases, to incinerators.

The problem of disposal is simply how best to hasten and ensure the natural processes of decomposition, the complete resolution into the original component mineral and gaseous elements or compounds of the food of animals and men, the final stages in fact of a decomposition already begun in the body. Many of the preliminary steps by which the complex organic molecule is naturally resolved into simpler compounds are doubtless of the nature of a hydrolysis brought about by enzymes in the absence of free oxygen (*e.g.*, insoluble albumens into peptones; urea into carbonate of ammonium), and this is a point of some importance in connection with the dissolution of the excess of suspended solids and extraneous rubbish (which is a prime characteristic of Indian sewage) in any method of biological treatment. But although the stages of complete purification are many and complex, the final result can only be obtained in one way, viz., by oxidation.

Oxidation may be brought about artificially by means of heat, naturally by the agency of microbes, either in presence of free oxygen or of reducible salts (*e.g.*, nitrate of soda); lastly by the vital action of living tissue-cells.

In the case of heat, oxidation may be—

(*a*) Complete, when the organic matter is entirely resolved, and no putrefaction products are evolved, implying a high temperature and free access of oxygen.

(*b*) Incomplete, when either by reason of the faulty construction of the incinerator, excess of moisture in the refuse or deficient fuel, the temperature is not sufficiently high, or oxygen does not obtain free access to all parts, and, as a result, partially decomposed products are given off, which, if not dangerous, are at least a very serious nuisance.

When we invoke the agency of microbes, the processes are analogous :—

(*a*) With abundant access of oxygen, and under suitable conditions of temperature and moisture, decomposition is complete, and there is not only no nuisance, but we have at our disposal a stock of available capital for replenishing our depleted soil and so maintaining the cycle of life.

(*b*) With deficiency of oxygen, or defect in the other necessary conditions, there is putrefaction with its drawbacks, if not dangers.

It is late in the day to re-affirm the great advantages and the superiority in every respect of Nature's method; but the artificial conditions created by the aggregation of large numbers of men on a limited area impose the necessity of furthering and assisting her efforts, which entails the exercise of care and judgment as to the form our assistance shall take in the varying conditions of the communities to be served.

The means of disposal in common use, then, are—

(1) Incineration.

(2) The discharge of the collected impurities into a water-course, sea or stream.

(3) The application to land, either by broad irrigation, by individual deposit on the surface, or by burial, more or less superficial.

(4) The new departure, or so-called "biological" methods now on trial in India as in England, in which the recognised agencies of the former methods (2)

and (3) are afforded fuller scope on a more favourable stage, and under more certain control. It remains to discuss briefly these various means of disposal, in the light of the conditions that prevail in this country.

(1). The destruction of valuable organic refuse by burning is purely artificial and altogether wrong in principle ; it entails immediate loss of the fixed nitrogen, so valuable an asset in the earth's economy. Besides this there is the cost and loss of fuel. To burn sewage is doubly wasteful in India, where both manure and fuel are scarce—the want of the latter re-acting on the scarcity of the former—because the people are driven to the use of cow-dung as fuel. Attempts have been made to render the process cheaper by using ordinary refuse to burn night-soil, but it is only rarely and under exceptional circumstances that the former is in sufficient quantity or sufficiently combustible to serve the purpose. In India the monsoon conditions militate against success in this respect, and as to the actual results, experience has shown that great nuisance (if not danger) from the evolution of partially decomposed products from lack of complete combustion is very general. The heaping up of night-soil to await combustion, where the incinerator capacity is insufficient, is another common source of nuisance and danger. Again the admixture of earth with the night-soil, as carried out in the dry-earth system, prevents combustion by heat ; incineration therefore involves the abandonment of the dry-earth system in latrines, with all its undeniable advantages. Lastly, this method fails to deal with the urine and slop-water, the larger part of the excretory refuse, and on this account alone it is sufficiently condemned.

(2). Where a sewered town is situated upon or near a river, the temptation to discharge its sewage into the stream has only too frequently been succumbed to, and while this method of disposal depends upon the chemical and, chiefly, the biological forces which the stream commands, the almost inevitable result has been to create a fresh and greater danger in the place of the one which it is the object to defeat. This of course refers to raw untreated sewage, which is commonly discharged in such amount, relative to the volume of running water, that the fauna and flora therein are unable to decompose it by the aid of the available oxygen (which is an uncertain and limited factor), with the most deplorable consequences to the river and to the health of the community. But the discharge into rivers of a "purified" effluent from sewage has come to be recognised as feasible and permissible, although the English sanitary authorities have not yet found themselves able to specify a standard of "purity." This is a question that the present Royal Commission may be expected to pronounce upon, with an approach to definiteness that has hitherto been impossible, and towards the solution of which the conclusions recently arrived at from the experiments carried out on the Manchester sewage and on the effect of the effluent obtained, upon the water of the Ship Canal, will materially assist.

The chief of the many methods devised to produce such "a purification" of the raw sewage are—

(*a*) The precipitation of the suspended, and an uncertain but small quantity of the dissolved, impurities by chemicals.

(*b*) The filtration of sewage through land.

(*c*) The new "biological" methods, similar in principle to the former, but not aiming at securing a profitable return.

Of the first it may be said that it is costly and only partially effectual ; the dissolved matters are but little affected, and the chief problem is untouched. The effluent is not prepared for further self-purification in a stream that may be used for domestic service.

Broad irrigation may be highly successful and even profitable, but it requires a large area of land, which within a certain range must possess certain characteristics ; the cost of land, of the necessary works, and of the skilled supervision are drawbacks, while the results as to the quality of the effluent are in many cases very questionable. Where good porous soil is available and cheap, at a convenient distance and at the proper level to be commanded by gravitation, broad irrigation may certainly be ranked in the first class of the means of disposal, where the sewage is not "heavy."

The "biological" methods of recent introduction are an adaptation of the principles of treatment by land filtration, and they depend upon the agency of micro-organisms, two broadly distinct stages being recognised in the entire process, just as has been shown to occur in the conversion of urea ; the products of decomposition varying with the different classes of organisms in action, and in the presence or absence of oxygen. Whatever the details adopted, the ends sought are attained by exposing the sewage to the action of the

micro-organisms with which it swarms, under conditions most favourable to their special functions, and ultimately, in all cases, in the presence of free oxygen. We can control the action of the micro-organisms to almost any extent desired; the area required for the treatment of large quantities of sewage and the expert supervision necessary are reduced to a minimum; climatic conditions, in the temperate and tropical zones, may be eliminated; a sewage, of almost any strength, may be adequately "purified"; and lastly, we retain the most valuable manurial elements, and as the chemical quality of the effluent is under control, we have the option of discharging it upon arable land, or into convenient water-courses. It must be admitted, however, that we have as yet no evidence that present biological methods will eliminate pathogenic organisms.

(3). Sewage may be simply discharged on to the surface of the earth and allowed to decompose, but unless the quantity be very small, and the place of deposit sufficiently far from human habitations and surface water-supplies, the practice is open to grave objections, especially in tropical climates under monsoon conditions, and measures should be taken to cover up the sewage with earth.

Again, the very prevalent practice adopted by Indian municipalities of burying excreta in deep pits is a modification of the old cesspool. Oxygen fails to get access to the mass, and we get a minimum of the desirable nitrification, with a maximum of slow putrefaction. The method is unscientific; it is slow and wasteful, always objectionable, and often dangerous.

"Trenching" stands in a different category, and provided it is carefully and properly carried out, it offers every advantage from the practical and scientific standpoints. It is indeed Nature's method in its simplest and most direct form; where land is available, of suitably porous character, well drained but with sufficient moisture; where the sewage is buried superficially and in moderate quantity, within the range of the nitrifying organisms and the access of oxygen, and where subsequent cultivation is not delayed, we have perhaps the most simple, scientific and adequate means of disposal for small isolated communities, where labour and land are cheap. One factor of prime importance is adequate and intelligent supervision; where "trenching" has failed in India and led to the employment of incinerators, it has been due to neglect or absence of one or more of the above conditions.

Coming now to the consideration of the various methods of disposal, it is obvious that the local conditions of each community must be taken fully into account. The conditions in India itself vary greatly, and as markedly from those which obtain in England, so that it is evident that a scheme which may be eminently suitable for one place is not necessarily desirable for, even if practicable in, another.

In England labour is very dear, land is valuable and the population is congested, and an organic system of water-supply and sewerage is very general; the problem to be faced, therefore, is the safe and expeditious disposal of a large quantity of fluid, comparatively lightly charged with organic impurities, without using much land in the neighbourhood of a town, and with a minimum of labour. The sewage of a large community, therefore, cannot be buried, and its discharge on to land has in most cases been accompanied by difficulties which have led to the introduction of the biological methods, which secure, at a minimum of cost, of labour and of land, an effluent that can be safely discharged into a river, under safeguards to water-supplies derived therefrom.

In India, on the other hand, the conditions affecting the majority of communities are very different—though water-supplies on European lines have been in some cases introduced, we have no complete organic system of sewerage as a direct adjunct to the water-supply, and we still live in the house privy and public latrine era. As a consequence of this and of the comparatively small quantity of water used for domestic purposes, the sewage will not bear comparison with that ordinarily dealt with in England, and it must be remembered that the daily average solid excreta of the native of India is from twice to thrice as large as that of a European. We have consequently to deal, in the main, with night-soil on the "dry" system; land is generally available, labour is cheap, microbial life is luxuriant, and there need be no question of an effluent. The best means of disposal therefore is, in the majority of cases, proper "trenching" on the lines, and under the conditions laid down; adequate supervision throughout, from the latrine to the disposal ground, being the great essential.

But we have seen how, in the cases of larger communities, other systems have had to be introduced, and the question has arisen as to how far the new biological methods may be adapted to Indian conditions, where circumstances prevent a direct application of sewage to

the land. Beginning tentatively, and dealing only with the domestic sullage water (including some urine) of individual dwellings, the Sanitary Commissioner with the Government of Madras, as early as 1895, devised a simple "filter" of ordinary porous material (gravel and sand), to be placed at the house-drain outlet, and which, in its most effective form, provided for the upward and downward passage of the sullage. Further, larger "bacteria beds" of similar material, but allowing only of intermittent downward filtration, were instituted by the same officer for the purification of larger quantities of the same "slop-water," where otherwise it would discharge into natural "tanks" or excavations near the inhabited site. It may briefly be said that these simple devices have amply fulfilled all expectations, and pending the introduction of arrangements for complete sewerage, they undoubtedly offer a scientific, safe and cheap solution of the problem of sullage disposal, which is indeed one of grave concern to all Indian sanitary authorities.

The first attempt to deal with the solid and liquid excreta on this system was made in Quetta in 1898, the apparatus being of a small experimental kind, on the lines of Mr. Cameron's Exeter process. The aim of Major Melville, R.A.M.C., who instituted and carried out this experiment, was to see what could be done with cantonment sewage diluted with equal parts of "slop-water," and subsequently with ten parts of water.

Owing to the short time at his disposal, this pioneer experiment was only carried on for three months, and no elaborate chemical analyses could be made; but the results were sufficiently encouraging as to make it plain that a very powerful addition had been made to our resources as regards the sanitation of cantonments, where owing to the nature of the soil, etc., the old system of earth-burial had fallen in disrepute, mainly as a probable factor in the prevalence of endemic typhoid fever.

Subsequently similar experiments on a larger scale were carried on in the Presidency Jail, Calcutta, and in Poona, in both instances on the lines of the Septic tank system; but the sewage treated in the case of Poona was considerably more dilute, the excreta of each person being mixed with 15 gallons of water. Here again the results have realised all anticipations, but the chief point of interest beyond the disposal of the excreta is the extraordinary manurial value of the effluent. Simultaneous cropping experiments were made on several small areas of land, to which poudrette, crude sewage, farmyard manure and effluent respectively were applied, the result being most markedly in favour of the last; it is confidently anticipated that a very large recuperative revenue will accrue on this account.

Lastly, it may be well to refer to some recent experiences gained in experiments carried out at Simla, since, owing to the strength of the sewage treated, the results attained have, like those of Quetta, considerable importance, with special reference to conditions peculiar to Indian communities, *e.g.*, cantonments, and to places where, although there be no organic water-sewerage system, smaller quantities of water are available, as from a stream or from light sullage.

The sewage treated was the crude night-soil (solid excreta with a varying amount of urine) together with the small quantity of ablution water each native uses, probably a pint on the average. Repeated experiments with "control" sewages artificially prepared showed that this consisted of from 8 to 10 ozs. of solids, from 15 to 20 ozs. of urine (for more than half the urine never finds its way to the depots), a varying amount of raw vegetable refuse, and some rubbish, rags, etc. The population is one in which the proportion of adults to children is very large, 6 or 7 to 1. To each night-soil unit with its pint or so of ablution water, five gallons of water were added from a stream which receives a certain quantity of the sullage drainage of the town, and in this way 500 gallons of sewage were daily prepared containing the excreta of 90 persons. It will be seen that, so far as the solid excreta are concerned, this dilution, as compared with an average of 3 ozs. per head for a European population, was only equal to something less than two gallons per head. Three small experimental installations were prepared; one on the Exeter plan, with a Septic tank of a capacity of 200 gallons, through which 100 gallons of the sewage were passed daily; the attached filter had a capacity when filled with "clinker" of 100 gallons. The second was a copy of the Dibdin double downward bacteria beds, 4½ feet deep, each having a capacity for 200 gallons of sewage, when filled with clinker of walnut size. The remaining 200 gallons of sewage were passed into a Scott-Moncrieff upward filtration tank or bed, and thence down through an aerating bed, which also accommodated the 200 gallons when plenished with finer clinker, 4½ feet in depth. These installations were worked daily save on occasional Sundays, for three months, the filters receiving but one charge a day; and for the greater part of the time the sewage was retained in them for periods varying from one to three hours; latterly it was allowed to flow through without retention.

Excluding the coarse adventitious rubbish which was screened off, the composition of this sewage was on the average of 10 analyses (controlled by analyses of artificially made sewage of the composition previously noted) as follows :—

	Grains per gallon.	
1. Total solids	304	Varying with the food grains ; large quantity of undigested grain and vegetable matter.
Solids in suspension	172	
Solids in solution	132	

	Parts per 100,000.
2. Ammonia (free)	14 to 16
3. Ammonia (albuminoid)	8 „ 10
4. Chlorine	16 „ 20

The chief points to be noted are the excess of suspended over dissolved solids, and the very large amount of albuminoid ammonia, due probably to the undigested grain and vegetable matters, and also to the relatively small amount of urine.*

It soon became apparent that the Dibdin beds could never work satisfactorily for more than a few days without requiring the removal of the felt of suspended solids which formed upon the surface and choked the pores of even the coarse material used ; but given that attention, the effluent from the lower bed was undoubtedly the best obtained, as might be expected, but the object of getting rid of the sludge was defeated. In this respect much more was hoped from the other installations, both of which call into play the so-called " septic " or putrefactive action of anaerobic organisms. This question has been so fully discussed of late that it need scarcely be entered on here, but the Simla experiments indicate that it is especially in very heavy domestic sewages that this stage of the " biological " methods offers the most advantages, and this was the most striking lesson afforded by the experiments. First, in this respect, the 300 to 350 grains per gallon entering the tank were invariably reduced to from 60 to 70 grains, of which only 5 to 10 grains were in suspension ; the result was identical from the passage through the upward Scott-Moncrieff bed. It should be noted that, whereas the sewage took two days to pass completely through the Septic tank, the full capacity of the Scott-Moncrieff bed was charged daily. At the conclusion of the experiment no deposit of sludge was found in the upward filtration bed, save a small layer half an inch thick, due to the last day's operations. The same may be said of the Septic tank, size $6' \times 2\frac{1}{2}' \times 2'$; the whole floor was covered with a layer of gritty sludge half an inch thick, while just below, in the inlet pipe, there was a small conical heap of $2\frac{1}{2}$ inches. Measurements had been taken at two spots in the tank every week, and at first there was a gradual increase in the deposit, which went on in a decreasing ratio for six weeks, and amounted at the most to $4\frac{1}{2}$ to 6 inches ; thereafter it steadily declined to the insignificant amount above noted. This settled satisfactorily one point of extreme importance in view of the nature of the sewage, and it only remains in this brief note to refer to the quality of the effluent.

A comparative tabular statement will best convey the facts of the means of the several analyses :—

	1	2	3	4	5
	Night-soil with 5 gallons of water per head.	Effluent from Septic tank.	Effluent from upward filtration bed.	Filtrate from aerating bed of Septic tank.	Filtrate from aerating bed of Scott-Moncrieff (upward) installation (No. 3).
		Parts per 100,000.			
1. Total dry solid residue	432	107	93	86	86
Solids in suspension	244	14	7	3	2
Solids in solution	188	93	86	83	84
2. Ammonia (free)	14·5	8·1	8·15	3·9	4·3
3. Ammonia (albuminoid)	9·3	2·8	1·9	1·08	0·9
4. Nitrates	—	—	—	1·1	1·42

N.B.—The chlorine was regularly present at 16 to 20.

* Fresh acid urine will give a total solid residue of roughly 2 oz. in 40 oz. of the fluid. A state alkaline urine yields little more than half this amount of solids.

It has to be noted that, although the "purification" attained may not be ranked as first class on some arbitrary standard, it is the result of contact with only one aerating bed, and all recent experiments have shown that almost any degree of purification may be attained by double or "multiple contact." But before finally appraising the affluent, one point of great interest remains to be noted. It is intended to discharge the final effluent into a rocky mountain stream, which has hitherto received the crude sewage to its great detriment. It seemed advisable, therefore, to enquire into the effect of mixing the above filtrate with the stream water, as it is obvious that a filtrate crowded with nitrifying organisms carries with it the means of self-purification if oxygen be supplied, as would certainly be the case in such a stream. Equal parts of filtrate and the river water were therefore mixed, and although analysis was carried out at once, the mean result of four analyses was as follows :—

	Parts per 100,000.
Ammonia (free)	0·93
Ammonia (albuminoid)	0·35
Nitrates	0·925
Chlorine	11·0

As the stream at its lowest yield will always provide a dilution of 6 or 7 parts to 1 of filtrate, there does not appear to be much left to desire on the chemical side of the question.

Without any pretention to a conclusive value, this note of a recent preliminary trial may serve to indicate a possible scope for biological methods under certain conditions in India.

Leprosy.—The volume* devoted to the report of the German Plague Commission contains a paper on Leprosy by Professor Sticker, of Giessen, of more than ordinary interest and importance.

Professor Sticker, who was one of the Commission, spent such leisure as he could snatch from his work in connection with plague in examining the lepers in the Matunga Asylum in Bombay; he also visited Nasik, where he examined 40 lepers, and, on his journey to Europe, he examined a few in Cairo and Alexandria.

The result of Professor Sticker's work is to show that the nose is peculiarly the seat of leprosy. It is in the nose that the disease begins; it is from the nose that it is spread; and it is in the nasal secretion of the sufferer that the bacillus of leprosy is to be found, if it is to be found anywhere.

Particulars are given of 153 cases, of which 57 were nodular, 68 were anæsthetic, and 28 were mixed. The bacilli of leprosy were found in the nasal secretion in 55 of the cases of nodular leprosy, the two exceptions being elderly women, in whom the disease had remained quiescent for some time. In the cases of mixed leprosy the bacilli were present in the nasal secretion in about the same proportion, 27 out of 28. In the anæsthetic variety of the disease the presence of the bacillus in the secretion of the nose was not so constant; in 23 out of 68 cases it was not found, but in 19 of these 23 cases the disease had made no progress for years. Moreover, it is probable that further examination would have reduced the number of negative results, for on several occasions the bacilli, although not found at the first examination, were discovered in abundance at the second. In almost every case, whether nodular or anæsthetic, young or old, recently acquired or apparently healed, some stage of ulceration of the nasal mucous membrane was to be found, generally over the cartilaginous portion of the septum.

Professor Sticker's experience leads to the following eight conclusions :—

1. The lesion in the nose, which generally contains and discharges large numbers of bacilli, is the single constant change in all cases of leprosy, in every form and stage of the disease.

2. The affection in the nose having the character of an ulcer or its sequel, although no trace of leprosy can be found elsewhere, must be something peculiar.

3. In every case of anæsthetic leprosy, whether it appears to begin on the hands, on the face, or on the feet, the leprotic lesion is virulent on the nasal mucous membrane as regularly as in cases of nodular leprosy.

4. So long as the leprosy is not completely healed, the nasal ulceration contains the bacilli in greater or smaller numbers. But even in cases apparently completely cured the nasal ulceration may remain virulent for years.

5. As a rule, relapses and extensions of the disease are heralded by local signs in the nose, particularly epistaxis.

* Arbeiten a. d. Kaiserlichen Gesundheitsamte, Vol. XVI.

6. The nodules of leprosy generally first appear in the immediate neighbourhood of the nose.

7. Signs referable to the nose, itching, severe epistaxis, catarrhs, swellings, etc., are described by many lepers as forerunners of their attack ; and such have long been known by the best observers as prodromata, although hitherto they have been erroneously explained.

8. The nasal ulcer containing bacilli may be found as the sole, and therefore the first sign of leprosy in children.

Professor Sticker gives the results of the examination of the nose in the 153 cases in the form of a table, which is reproduced below :—

		Cases in which the nasal mucous membrane appeared healthy.	Dry inflammation to ulceration.	Superficial atrophy of the mucous membrane.	Swelling of the mucous membrane with or without catarrh.	Contraction of the nasal passages.	Ozæna.	Advanced destruction of the frame of the nose.	Perforation of the Septum.
Nodular Leprosy	57 cases								
Cases with bacilli in nasal secretion	55 „	2 (12)	18 (8-45)	1 (11)	—	13 (8-50)	6 (12-60)	15 (10-60)	10 (10-55)
Cases without bacilli	2 „	1 (60)	1 (45)	—	—	—	—	—	—
Anæsthetic Leprosy	68 cases								
Cases with bacilli	45 „	6 (5-45)	10 (10-60)	1 (55)	2 (8-10)	5 (20-45)	5 (20-50)	16 (15-66)	11 (15-66)
Cases without bacilli	23 „	8 (12-60)	1 (45)	4 (40-66)	—	1 (60)	1 (45)	8 (45-50)	2 (50)
Mixed Leprosy	28 cases								
Cases with bacilli	27 „	1 (5)	4 (10-52)	—	4 (14-36)	3 (23-45)	3 (20-50)	12 (14-65)	11 (14-45)
Cases without bacilli	1 „	—	—	—	1 (12)	—	—	—	—
Total of all cases ...		18	34	6	7	22	15	51	34

The figures in brackets give the approximate limits of the ages of the lepers.

The practical conclusions are that in every case where leprosy is or may be suspected, the secretion of the nasal mucous membrane should be carefully examined for the bacilli of the disease.

Severe nasal catarrh, commencing ozæna, and, above all, frequent bleeding of the nose, occurring among persons who have lived long among lepers are suspicious, and require careful bacteriological examination and timely local treatment.

Doubtful cases of leprosy may be cleared up by discovery of the bacillus in the nasal mucous membrane.

A leper in whom the skin and nervous lesions have long ceased to progress can be regarded as free from danger to his surroundings, only when the complete healing of the primary affection in the nose is established by examination.

Therapeutic measures should be directed to the destruction of the disease in the nose, since experience teaches that all secondary manifestations tend to spontaneous cure, while the nasal affection is extremely persistent.

Tuberculosis.—At the International Congress on Tuberculosis, held at Berlin on May 24th to 27th, 1899, Lieutenant-Colonel A. Crombie, M.D., Indian Medical Service (retired), was the delegate appointed to represent the Government of India. This officer has furnished a most interesting report on the proceedings, with special reference to the prevalence and prevention of the disease in India, and it has been included as an appendix* to this section.

* Not reprinted.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1900.

(*Lieutenant-Colonel W. G. King, C.I.E.*)

General Population.

The population of the Madras Presidency, according to the last census, was, inclusive of Europeans and Eurasians, 35,641,828. The estimated population for 1898 is 37,715,417. The census population for which returns of vital registration were received, amounted to 33,288,122, or 93·4 per cent. of the total. Emigration and immigration statistics show that the Presidency lost 68,247, against 92,118 in the previous year, which was one of scarcity, and consequently favoured emigration. Of this number, about 98 per cent. was contributed by the districts of Ganjám, Vizagapatam, Gódávari, Madras, Tanjore, Madura and Tinnevelly. The migrations were chiefly to the ports of Burma, Ceylon and the Straits Settlements. The "natural increase" of the population under registration amounted to 212,774. Compared with the previous year, the population brought under registration shows an increase of 649,879. This has been effected in the districts of Madura, Ganjám, and Vizagapatam.

No change has been made in the system of registration. This was fully described in the report for 1893, and need not be here repeated. It is unlikely, until the Village Proprietary Act comes into force, that any great improvement can be effected in registration in rural areas. As illustrating the influence which is exercised by districts where zemindari tracts are large, it may be said that if the districts of Ganjám, Vizagapatam and Madura, where these predominate, be excluded from the calculation, it is found that instead of the total death-rate for the Presidency (as subsequently shown) being 21·0 it becomes 21·5 per 1,000, and the birth-rate, instead of 27·4, becomes 28·2 per 1,000.

Births in Districts.—A total of 911,742 births was registered during the year, affording a birth-rate of 27·4 per 1,000 upon the census, and 24·3 upon the estimated population. This represents a decline of 1·1 per 1,000, in the birth-rate when compared with the five years' average, implying a loss to the population of 36,573 souls. On looking at the figures for the various districts, it will be recognised that this decline has not been brought about by a single factor. There is no system of registration of marriages in this country—although were one introduced it might well yield an income that would go largely towards the development of a vital statistics department; but, there is reason to presume that marriages have been deferred during the last three years, as far as feasible; that is to say, as far as the caste customs directing marriage of a female within a certain age will allow, because evil times have been prophesied. Again, the decline in the birth-rate that was alluded to at page 32 of the last year's report as having already exhibited itself in the districts affected with famine* (1896-97) necessarily was more pronounced in 1898.

But, in the case of Madura, which shows a decline in the birth-rate, and claims, moreover, the highly satisfactory figure of 15·6 per 1,000 for its death-rate (notwithstanding the presence of cholera throughout the year in the midst of the population) I consider the main cause is defective registration. It is presumed this has chiefly occurred within the zemindari areas. The heavy fall in the birth-rate in South Canara cannot be so accounted for, and its seems probable, therefore, that this district approached a critical condition owing to the high price of food-grains during a portion of 1896-97. It will be remembered that the districts of Bellary, Kurnool, Cuddapah, Vizagapatam, and Ganjám were recognized officially as affected with famine. Of the total decrease in the births, 63·0 per cent. is due to these districts. Parts of the districts of Malabar, Chingleput, North and South Arcot were also recognised, during the continuance of high prices, as approaching a condition where public help would have been necessary. These districts contribute 33·1 per cent. of the total decrease. On the other hand, increase of the birth-rate over the average occurred in districts where the chief

* The Ceded Districts alone were considered.

characteristic is the large extent of country under irrigation, affording the agricultural coolie a fair amount of certain labour. Thus the districts of Trichinopoly, Gódávari, Kistna, Tinnevelly and Tanjore yielded 20,149 more births than warranted by the average for the previous five years. Births of boys to girls were in the proportion of 104·3 to 100 girls, against 103·9 and 100 of the previous year. The birth-rate according to classes was :—Native Christians 22·9, Muhammadans 23·5, and Hindus 27·8. In the previous year, the rates were 23·7, 25·4, and 22·3, respectively.

Births in Municipalities.—The total birth-rate in municipalities was 34·9 per 1,000, against 34·4 of the previous year, and against 27·4 for the total Presidency for 1898. Notwithstanding that, of a total of 59 municipalities, 25 exhibit a decrease below the average of the previous five years in the aggregate, there has been a gain in the birth-rate of 0·5. The gradual increase of the recorded rate (not be it remembered the true rate according to either the census of Stokes or Stuart) due to the influence of better registration and of increasing increments of population, is shown in the following table :—

Years.	Birth-rate per 1,000 of population.	Years.	Birth-rate per 1,000 of population.
1892	31·4	1896	36·1
1893	34·1	1897	34·4
1894	33·2	1898	34.9
1895	35·3		

Deaths in Districts.—699,108 deaths were registered, giving a total death-rate on the census population of 21·0, and, on the estimated population, of 18·6 per 1,000. This is a decrease of 4·4, when compared with the previous year. This is accounted for chiefly under cholera, fever, and dysentery and diarrhœa. The distribution of death causation is given in the following table, which also enables a comparison to be made with the previous years :—

Years.	Birth-rate per 1,000 of population.	Death-rate per 1,000 of population.						
		Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other causes.	Total.
1892	25·1	2·3	1·3	8·3	1·9	0·3	9·0	22·3
1893	27·0	1·0	0·8	7·7	0·7	0·3	8·8	19·3
1894	27·7	1·3	0·3	8·0	0·7	0·4	9·3	20·0
1895	29·1	0·6	0·1	8·3	0·7	0·3	9·6	19·6
1896	29·9	1·5	0·3	8·0	0·7	0·3	9·8	20·6
1897	28·7	4·4	0·7	9·0	1·2	0·3	9·8	25·4
1898	27·4	2·0	0·6	7·5	0·9	0·3	9·7	21·0

When compared with the previous year, the districts of Chingleput, Kistna, Nellore, Nilgiris, Salem, South Arcot, and Trichinopoly showed an increase in the total death-rate.

The total death-rate in rural towns was 19·0 per 1,000, against 21·0 for the Presidency, and 31·9 for municipal towns. The infantile death-rate, per 1,000 of births, was 163·3—a rate of 1·2 per 1,000 less than the previous year, and 6·4 higher than in 1896. This result points to the influence of the higher price of food-grains on the obtaining of luxuries suitable for infant life during 1897-98, and the production of weakly infants by ill-nourished mothers.

Deaths in Municipalities.—The total death-rate in municipalities amounted to 31·9 per 1,000, against 33·3 for the previous year. There was a decrease of mortality in 39 towns. Sixteen towns showed an increase of over 1 per 1,000. In certain of these an increased mortality has been registered under the indefinite head of "all other causes." Thus, under this head in municipalities, during 1898, a greater proportion of deaths has

been registered than hitherto. This might be explained on the theory that, as education advances, it is becoming increasingly common to specify the real cause of death, as diagnosed by a qualified medical man, instead of confining statements to the simple heads given in the register ; but the increase (1·8 per 1,000) is of too sudden a nature for this theory to satisfactorily account for it. It is more probable that the "plague scare" has caused alteration in methods of registration elsewhere than in the City of Madras. Such an explanation does not, however, get rid of the fact that increased total mortality actually existed in certain instances, and the suspicion may naturally arise that, in, say, Tiruvannámalai—a pilgrim resort—in the absence of any registered increase of cholera and fever, the heavy rate of 12 per 1,000 above the previous year must be due to some new condition, for example, unreported plague. It is, however, a municipality that has been well drilled as to sanitary precautions in reference to festivals, and it may be taken for granted that the selection of "all other causes" for registration was induced by self-interest on the part of the inhabitants, whilst activity in registration in this but lately constituted municipality may really account for the greater part of the supposed total increase. The probable actual cause of increased total death-rate in the City of Madras (cholera falsely registered) is alluded to under "Fevers."

The infantile death-rate in districts and towns is noted below. It is held that the demand of factory life upon a large number of the female population of England, tells most adversley upon the infantile death-rate, owing to insufficient time available for females to attend to their infants. In 1898, the London decennial average infantile death-rate was 151, and for the 33 "great towns" in England the same average rate was 167. If these figures be contrasted with those exhibited below, it will be seen that the death-rate amongst infants in this country is appalling. As both rates are reckoned per 1,000 of births, they are strictly comparable—the error, if any, being most probably in the full mortality of Madras infants not being correctly exhibited ; that is to say, that births in this country are more likely to be registered than the deaths of infants. I have, in a former report, adverted to the cause of such heavy mortality, namely, the ignorance of the poorer classes of the most simple ideas of sanitation, in connection with child-life. There need be no question as to purposeful neglect. The mothers of the uneducated classes in this Presidency cannot be excelled in any nation as to devotion to their children. The advent of a female infant is certainly regarded as somewhat humbling to the pride of the head of the family, still she gets fair treatment so long as, at reasonable prices, food is obtainable ; when grain becomes dear, it is possible that the male child would receive the greater share of attention. The gradual rise of wages will ameliorate conditions following the high price of grain in time. The matter of ignorance of mothers can only be altered by better attention to spread of general education and of sanitary knowledge amongst them.* It will, however, be noticed if Madras be placed in its proper place as a municipality, and be not regarded as a district, that the total district infantile death-rate becomes 160·6 per 1,000 of births, which is not much above that quoted for London, and is less than in the 33 "great towns." Probably, an infant's death in a rural area is less likely to be registered than that in a municipal town ; but, allowing for this fact, the rates are so enormously to the disadvantage of the latter that they cannot but be regarded as the expression of the insanitary conditions incident to the inhabiting of sites crowded with dwellings, inefficiently protected by the present type of municipal efforts towards rubbish and night-soil removal, unprovided with sewerage systems, and frequently possessing water-supplies innocent of the most simple modes of protection.

If it be granted that to a number of towns this description be correctly applied, the question as to which shall exhibit the heaivest infantile death-rate, would ultimately be determined by the relative capability of the soil to dispose of sewage reaching it, in respect to its nature and configuration, and proximity of the sub-soil water ; all matters that possibly affect the *bacillus enteritidis sporogenes*, and other forms of microbic life having a relation to intestinal fluxes. Bellary may well be regarded as a town whose sub-soil is saturated with sewage ; its rate is 324·9 per 1,000 ; the same may be said of Negapatam ; its rate is 276·2 ; and of Madras, with its 297·7 per 1,000, the same is true. In the case of Ootacamund (304·5) not only has the soil saturated with sewage in the neighbourhood of the native dwellings to be thought of, but the rigour of its climate. It is noteworthy that in Coonoor, the major portion of which is drained, but where the climate factor is also to be contended against, the rate is 190·5 per 1,000.

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* The desirability of efforts for spread of sanitary knowledge amongst women is, I am glad to say, engaging the attention of several native gentlemen, notably, C. V. Swaminatha Aiyar, editor of the *Viveka Chintamani*.

Chief Diseases.

Cholera.—A total of 65,444 deaths occurred from cholera, yielding a rate of 2 per 1,000 of the population of the Presidency, against 4·4 per 1,000 in 1897, and a decennial average of 2·1 per 1,000. The incidence of the disease was very heavy in Tanjore (6·7), Trichinopoly (5·5), South Arcot (5·2), and Kistna (2·9). These are the great irrigation centres of the Presidency, and offer good facilities for the transmission of the cholera microbe from village to village by means of lengthy channels that are liable to contamination by reason of the insanitary habits of the people. The only district where irrigation under this plan is not carried out largely that was much affected was Nellore, where the death-rate from this cause was 2·8 per 1,000. This was the district affected with famine during the year. Granting that no cases of "famine diarrhœa" were included in the returns as cholera, the various conditions incident to scarcity indubitably predispose the individual to attack, and to spread of the disease in the community concerned.

The measures taken to combat the disease in rural areas by the local authorities, in spite of reminders, cannot be described as adequate. Notwithstanding the training of a large number of Certificated Sanitary Inspectors available for special work in connection with epidemics, Local Fund bodies cannot readily be prevailed upon to undertake systematic measures with the aid of these men. Matters are, however, very much better than a few years back, when the chief idea of certain Local Fund bodies in dealing with cholera was to distribute "cholera pills," by means of vaccinators. Hospital Assistants are detatched, if somewhat tardily, for this duty, and attempt to combat conditions (for which they are not specially fitted as in the case of Certificated Sanitary Inspectors), more especially with reference to specific contamination of the water-supplies of villages. These bodies, however, almost invariably fail to support their efforts by supplying menial staffs necessary to ensure correct sanitary results.

The rules for combating cholera in municipalities laid down in G.O., No. 1,536 M., dated 9th September, 1896, continued in force. As remarked in last year's report, their utility is greatly minimised by the power left in the hands of the Collector to approve of any smaller staff being employed than that laid down in the rules as the minimum. Although the Order provides definitely for the provision of sufficient funds for effecting the scheme, the first thoughts of Chairmen of Municipalities seem to be how cheaply the system can be nominally effected, and, apparently on the ground of economy, this is a policy that is not actively disapproved by the collectors. The Government Order also places in the hands of the collector the most important task of giving the warning to the municipality, as to when it is necessary to put in force the rule requiring the employment of a staff for observation. No instance has yet come to the notice of this office of collectors having given warning to municipalities *at this stage*. Consequently, the system which contemplated a method of observation, which should secure rapid action, on the introduction of the first case of the disease, has degenerated into a method of prevention of spread, *after the disease has exhibited itself*. The effecting of sanitary measures against epidemic disease demands at the hands of the local bodies responsible a rigid adherence to certain principles and methods; relaxation of these, at the option of this or that official, condemns their original necessity, and permits of flaws that stultify them.

In the municipal towns of Palni, Nellore, Chidambaram, Mannárgudi, and Trichinopoly, the disease was severe. Of these, Trichinopoly is the only town in which the rules above referred to are in force.

On making a comparison of the total population under the rules and those not, the incidence of the disease is found to be as follows:—

	Incidence of cholera in			
	1895.	1896.	1897.	1898.
Populations under the Cholera Rules in 24 towns=987,835.	0·7	2·3	5·3	2·2
Populations *not* under the Cholera Rules in 21 towns=428,914.	0·8	3·3	7·6	1·8

Had the populations under the rules been attacked at the same rate as those not subject to them, they would have lost, during 1895 to 1898, 2,964 more lives than they actually did.

Small-pox.—There occurred 20,490 deaths from small-pox. This represents a rate of 0·6 per 1,000 upon the census population. Within the last three years there has been a steady improvement in the rates within municipal towns as compared with their surrounding rural areas. This is possibly *inter alia* due to the influence of G.O. No. 1502 M., dated 19th October, 1894, which demands that the Chairman shall give a complete account of the methods of disposal of all births that have been registered, and have arrived at an age to receive vaccination.

The frightful rate of 12·2 per 1,000 registered against Ganjám, during 1897, has undergone a decline; though in 1898 the mortality from this cause (8·5 per 1,000) was still of a most serious nature, It will be remembered that the impetus given to the disease during 1897 was due to famine conditions, leading to the crowding of the people upon works. What with the existence of extensive hill tracts inhabited by a class of people who probably would much prefer inoculation t o vaccination, and the impossibility of dealing satisfactorily with any sanitary subject in zemindari tracts, Ganjám presents a most unpromising field to the sanitarian. Indeed, so little has it been considered possible to deal with this district by ordinary methods, that for the last ten years, in the hill tracts, the entire responsibility for administration of the Vaccination Department has been in the hands of the civil authorities,

In judging of the magnitude of small-pox epidemics, it is well to hold in mind that under our present system of registration in rural areas, and to a less extent in municipal towns, deaths from measles are apt to be included under "small-pox."

Fevers.—It is a trite statement, but one necessary to be held in mind that, under the head of "fevers," the majority of all affections in which pyrexia is a prominent symptoms are likely to appear, as a sequence of the present system of registration and state of medical advane of the country. Nevertheless, it is safe to assume that the greater number of deaths so registered are due to malaria. In the year under review, there were 248,638 deaths, from fevers, which represent 35·6 per cent. of the total mortality reported, and a death-rate from this special cause of 7·5 per 1,000 of the population, against 9·0 of the previous year. The decrease was chiefly marked in districts that in 1897 had been affected with famine; but, in Anantapur, it is trivial. From this may be argued better nutrition and better resisting power to malaria of the people of these districts. A marked exception to the general decrease is exhibited in the case of the Nilgiris, where the death-rate of 22·1 per 1,000 from this cause was registered, against 17 per 1,000 in 1897. This was accompanied by a fall in the birth-rate. If this does not represent mere vagaries in registration, the only feasible explanation, in default of special investigation, is the departure from the rainfall conditions of 1896, representing a gradual decline and, consequently, a changed line of saturation of the sub-soil influencing the production of the malaria germ; thus, in 1896, the total rainfall was 85·47 inches, in 1897, 76·75 inches, in 1898, 70·32 inches.

It is probable that the death-rate from fever in Madras town does not represent the truth. During the prevalence of cholera, there was an increased registration of deaths under "fever." A joint investigation by the Health Officer and myself, satisfactorily proved that the apparent increase had been brought about by false registration of cholera under that head. Subsequent to October, however, a decline in fever below what might normally be expected, during the last quarter of the year, occurred. This result has been stated by the President of the Municipality, to be due to people reporting an abnormal number of cases under "other causes." "Dysentery and diarrhœa" had become an unsafe head under which to register, as it was likely to be followed by enquiry as to cholera. On the occurence of plague in the Mysore territory, and increased vigilance of the sanitary staff as to "fevers," it became unsafe to register under this head, lest enquiry should be made as to plague. Hence, the refuge for false registration under the convenient head of "other causes," has been fully utilized. The following statement illustrates these facts, and affords a curious illustration of the difficulties the sanitarian in this country encounters,

in attempting to interpret registration results, in reference to the health state of populations :—

——	Years.	July.	August.	September.	October.	November.	December.
Cholera	1897	0·3	1·1	1·0	"Plague scare."		
	1898	2·3	7·6	4·3			
Fevers...	1897	10·8	13·2	11·5			
	1898	15·0	19·8	16·0			
Fevers...	1897	Cholera prevalent.			12·9	10·5	9·8
	1898				5·3	3·7	2·5
All other causes	1897				17·7	17·2	18·6
	1898				25·9	25·2	26·8

The death-rate from fever in municipalities was 7·5 per 1,000, the same rate as in districts as a whole, that is, including municipalities, The highest rates were registered in Cuddapah (14·8), Kurnool (12·5), Madras (12·4), Ootacamund (11·8), and Vizianagaram (11·7). I have already shown, in former reports, that the variation in the fever rate in Madras town follows closely the fluctuations of the sub-soil water. In my inspection notes of 1894 on the town of Madras, I showed that the "period of greatest mortality is that which immediately follows the greatest fall of the subsoil water level, and heralds a commencing rise." In my report on the same subject, embodied in G.O., No. 672, Public, dated 28th May, 1897, I also pointed out that the incidence of fever, diarrhœa, dysentery, and cholera, is influenced by sub-soil water fluctuation, more especially during the stage of depression. This term "fluctuation," I may state, was used in reference to variation from a known normal period regarded as a standard. I also pointed out that, for the time being, the town exhibited during the continuance of a high sub-soil water level greater freedom from fever ; this qualification being with reference to the fact that a fall subsequent to a great rise—a heavy fluctuation—would be followed by increased mortality. These statements from records maintained in this office seem justified. In the absence of any other observations, the levels hitherto trusted to have been those supplied by the Military Works Department in respect to the Seven Wells water-works. These, however, cannot be regarded as fully satisfactory. Systematic observation in suitable localities throughout Madras would seem most desirable. I specially draw attention to this, as the data at my disposal show that since the North-East monsoon of 1896, there has been a tendency for an abnormal rise of the subsoil water. There has also been of late years an increased consumption of Red-hills water in the but partly drained city, as shown by the following statement, that must at least add to soil moisture :—

	C. ft.
1896	436,953,834
1897	476,215,173
1898	488,625,534

There are reasons with reference to the diminishing use of the Seven Wells Water, why the supposed rise of the sub-soil water may be less than supposed ; but the chances are that a fluctuation of this nature has occurred. In this connection, the fact is worth remembering in regard to future prospects as to plague.

In Cuddapah also the incidence of fever prevalence is, within certain limits, affected by the rainfall, and, it may therefore be safely argued, by fluctuations of the sub-soil water, as will be seen from the following statement :—

Official years.	Total rainfall in inches.	Death-rate from fevers.	Official years.	Total rainfall in inches.	Death-rate from fevers.
1890–91	32·15	19·3	1895–96	33·02	14·9
1891–92	15·40	14·1	1896–97	20·57	19·2
1892–93	44·68	22·2	1897–98	31·11	13·2
1893–94	38·97	29·6	1898–99	*27·85	*14·7
1894–95	34·86	16·9			

* Obtained from the statistics of first nine months of 1898–97.

Dysentery and Diarrhœa.—The rate for deaths from "dysentery and diarrhœa" fell from 1·2 of the previous year to 0·9 per 1,000 of the population. This less frequency of bowel affections may fairly be regarded as due to improved dietary of the people, following the fall in the price of grain. The decrease occurred in all districts except Madras, Chingleput, Nellore, Salem, and South Arcot. The greatest mortality occurred in the months of January, November, and December. I have already referred to the condition of the soil as influencing infantile mortality—usually by inducing catarrh affections of the intestine. The intimate relation of soil and water, however, further forces itself upon notice in considering the mortality at other ages. It is, of course, possible to have a town situated on sewage sodden soil supplied with pure water, should it be brought from beyond the contaminated area ; but, it may happen, that a pure derived water from the outside, may, under several circumstances, be defiled by the sewage-laden soil. It is, in short, difficult to escape the penalty of the close connection between the soil and water. Thus, there heads the list of mortality from diarrhœa and dysentery within within municipal towns, Tuticorn, which yields a rate of 9·3 per 1,000. In this town, water is received from a tank 4 miles distant. It is open to contamination on its way to the town, but probably to nothing like the extent it is on delivery within the town, as old and pervious pipes are employed emptying into pervious cisterns forming dip-wells. The sub-soil passed through contains much brackish water, and the filtered sewage of the town —which has no sewerage system. The Sanitary Board has recently, against my advice, approved of a scheme for improvement of the water-supply on the principle of protecting it during its transport to the town, but neglecting its protection when passing through the sub-soil in the pervious conduits referred to, and when exposed in the open wells. It will be of advantage to note the result upon the "dysentery and diarrhœa" rate, in future years, of this halting policy. In Cochin, which has the next highest rate (7·5), the water obtainable is brackish and presumably, sewage tainted—considering the nature of the surroundings. Such fairly pure water as is obtainable, is procured at great expense by boat from a distance of 12 miles. The prevalence of filariasis to an extent to cause the name of "Cochin leg" to be synonymous with elephantiasis, sufficiently bespeaks the fact that the water of the locality is open to lodgment by the mosquito. The fact that Madras (7·5) possesses a public water supply, (albiet delivered unfiltered after passage through an unprotected channel) by no means implies that the people obtain the full possible sanitary benefit from it. There hardly exists a house in the thickly inhabited areas that does not have on its premises an open well, with pervious steining, two or three paces removed from the latrine. Of course, the plea is that such water—chemically little better than a sewage filtrate—is used solely for the washing of eating and cooking vessels ; but this statement does not absolve from the sanitary sin, nor its consequences. As for Coonoor with its rate of 6·3, it affords a lamentable example of a town being surrounded with pure water sources, but allowing such as it possesses to be grossly defiled by absence of protection.

Injuries.—Under "injuries," the practically invariable figure of 0·3 per 1,000 was registered. It is evident that neither the increase of railways nor of manufactories—the latter being in number still very small and under full operation of the Factory Act—has sufficed to cause any marked result on mortality.

All other causes.—Although, as remarked in discussing registration, there was an increased tendency in municipalities to register under this head, owing to "plague scare," the total was not sufficient to affect the supposed incidence in the population as a whole. The figure for 1898 (9·7) approximates closely that for 1897 (9·8).

Sanitary Works.

Municipalities.—It might have been thought, with plague threatening to invade the Presidency, that the improvement of the sanitation of municipal areas would have been carried on with unusual energy. In the matter of attempting to make the best effort with the means available, this is probably the case, but it is not possible to record any departure from the routine that would signify the introduction of new methods, or additions to those already in existence. The funds available in 1897–98 were "nursed" carefully by municipalities, because it was not till the success of the north-east monsoon was established that all fears of famine had departed ; during 1898, there existed the restraining influence of the knowledge that, should plague invade the Presidency,

there would be great difficulty in meeting the expenditure required for special measures to combat it.

46. The following statement shows the expenditure on sanitary improvements.

	1897–98.		Rate per cent. of expenditure to total allotment.	1898–99.		Rate per cent. of expenditure to total allotment.
	Amount sanctioned.	Amount expended.		Amount sanctioned.	Amount expend edduring the nine months ending December, 1898.	
	£	£		£	£	
For conservancy	43,155	41,863	97·0	47,340	33,212	70·2
For improvement of village or town sites.	18,929	16,382	86·5	15,950	10,136	64·0
For improvement of water supply, cleansing, repairing, and construction of tanks and wells.	65,062	33,241	51·0	31,140	8,021	26·0
For sanitary arrangements during fairs and festivals.	894	795	88·9	899	499	55·5
For construction and repair of markets and slaughter-houses.	2,645	1,571	59·4	1,303	550	42·2
For other sanitary outlay ...	7,993	7,186	89·9	8,138	3,911	48·0
Total	138,678	101,038	72·9	104,770	56,329	53·8

In my report for 1895, I drew attention to the advantage that would accrue to municipalities not provided with a sewerage system and not likely to be in a position to undertake a complete scheme, by introducing the Shone's system permanently for night-soil disposal by pail depôts and, subsequently, by gradual extension, for receipt of sewage from areas within a reasonable distance of these depôts. Since then, I have been in communication with Messrs. Ault & Sons, the patentees, who agree with me as to the practicability of the method. An estimate was framed for the town of Bellary showing that the total night-soil of a population of 59,467 could be discharged upon farms outside the town at an initial cost of about 1 shilling per head. This suggestion must not be confused with the use of the Shone's system for a complete sewerage scheme. The proposal looks solely to disposal of night-soil in a more cleanly and expeditious manner than at present by the cart system, whilst sewage can be added for section after section of the town as funds or inclination decide. Such a method, of course, ought not to be applied, when a complete scheme, intended to deal with night-soil as well as sullage water, can be afforded within a reasonable period. Its correct place would be the serving of towns which are in debt for water schemes, and are not likely to be able to find funds for complete sewerage during this generation.

In the sanitary history of municipalities, during the year, the "typhoid fever scare" at Ootacamund attracted some public attention. The cases were but few; the social position of the patients, however, induced considerable publicity. The fact that sporadic cases of typhoid fever are not unknown in Ootacamund, has been recognized for many years. This being so, I sought in my Inspection Notes in 1893 and in 1896, and, again, in discussions with the Collector, Chairman of the Municipality, and Sanitary Board, in 1896, to force upon notice those improvements connected with the protection of the water-supply, night-soil concervancy, milk supply, and clothes washing, which the existence of this special disease obviously demanded. In face, however of the good health of the station in those years, these warnings were regarded by some of the officials concerned as due to the theoretical tendencies of the votaries of sanitation. Nevertheless, Government took the matter into consideration, with the result that much data have been laboriously collected in regard to improvement of the water-supply, certain urgent defects as to the main sewer have been attended to, and a scheme for sewerage has been worked out. The lesson derived from the incident is that it is difficult for municipalities to comprehend that the function of the sanitarian is not solely to deal with epidemics that are existent, but to give timely warning of the defects that may bring them about. As stated under "Personal Proceedings," the investigation of the occurrence of typhoid fell to Major Thompson, I.M.S., who acted during my absence on leave. He submitted a

valuable report on the subject, which confirmed the sanitary pleadings of myself and my Deputy during the preceding years.

The income derived by municipalities by the sale of night-soil is gradually undergoing an increase, as the utility of this form of manure is better appreciated ; money realized by sales at the end of this decade has exceeded that at its opening by about £670. I regret that I can place on record no further advance as to sewage farming. It was practised in the following towns:—Madras, Erode, Tanjore, Anakápalle, and Vizagapatam. Tinnevelly purchased a plot of ground, but, beyond this, took no further step in the matter.

The question of improving the condition under which sewage farming shall be conducted at Tanjore, still engages the attention of the Sanitary Board.

Filtration of sewage is conducted at Vizianagram, Vizagapatam, Kumbakónam, Bezwada, Negapatam, and Rajahmundry, and on a small scale at Bellary. A Sanitary Inspector engaged on plague duty has also informed me that he successfully introduced this method in certain villages for disposal of sewage, where no regular system for removal existed. Sewage filteration (by means of "filter trenches") is recognized in the official regulations as the method to be adopted in the health camps, during plague operations.

In Madras City, night-soil and rubbish disposal continued under the usual unsatisfactory conditions. The incinerator, which will deal with part of the rubbish, was under construction. In Mylapore, an under-ground sewerage system was completed. I regret to say the principle of receiving sullage water, to the exclusion of night soil was adopted.

District Boards.

The Act for Local Fund areas is, I understand, in a state of revision that will shortly permit its appearance. If it embraces certain of the points I anticipate, it will bring about an enormous advance of sanitation in rural areas, and provide the requisite funds. At present, the necessity for husbanding funds for plague purposes, mentioned in reference to municipalities, was more marked in District Boards. The result was a fall off in the amounts allotted for sanitary purposes of a routine nature. The sums allowed by various districts differed within wide limits, the proportion of income allotted in certain of these being absolutely inadequate. The President of one of the Boards, which gave a contribution to which this term may be safely applied, has defended this position by pointing to some absurdities in the way of attempts at conservancy in villages ; but, with the same breath, allows that such results are due to want of supervision, ignoring the simple fact that did his Board allot sufficient funds supervision could be obtained. Per head of population served, the total expenditure by District Boards upon sanitation during 1897–98 amounted to only 3·1 pies or about one farthing at current exchange.

The following statement exhibits the expenditure on sanitation during the year:—

	1897–98.			1898–99.		
	Amount sanctioned	Amount expended.	Rate per cent. of expenditure to total allotment.	Amount santioned.	Amount expended during nine months ending December, 1898.	Rate per cent. of expenditure to total amount.
	£	£		£	£	
For conservancy	23,294	20,683	88·8	23,258	16,611	71·4
For improvement of village or town sites.	5,233	2,415	46·1	5,008	1,797	35·9
For improvement of water-supply, cleansing, repairing, and construction of tanks and wells.	10,095	7,812	77·4	8,814	3,703	42·0
For sanitary arrangements during fairs and festivals.	1,189	1,108	93·1	1,120	599	53·5
For construction and repair of markets and slaughter-houses.	4,364	2,888	66·2	3,530	1,275	36·1
For other sanitary objects	2,182	1,546	70·9	2,097	671	31·9
Total	46,357	36,452	78·6	43,827	24,656	56·2

It is a maxim in sanitation that epidemics do not come to populations as unmixed disasters. They force upon the authorities responsible, facts that much report making would not convince them of. Should, however, plague persist in this Presidency, before any advantage can take place, the chances are that routine sanitary improvements will be very materially decreased in number and value, owing to the demand for funds. Even the sanguine sanitarian finds at last that it is hopeless reporting to bodies that have no funds to bestow on the improvements he indicates. Not only is advance thus likely to be impeded in sanitary matters proper, but the prophylactic action of vaccination is likely to receive material check. As will be further explained in the Vaccination Report, the people (more especially of rural areas), have confused anti-plague inoculation with vaccination, with the result that a very heavy decrease in operations has occurred throughout the Presidency, The result must be, in the end, a greater loss of lives by small-pox than can have been saved by anti-plague inoculation. In short, the maxim will doubtless remain true: as an effect of the "plague scare" sanitation in the Presidency will advance, but *when* this will occur the future alone can show, and in the meantime, an approach to stagnation is the immediate result.

Personal Proceedings and General Remarks.

At the beginning of the year, the Government Order requiring me to devote my attention to plague and famine matters, instead of routine sanitation continued in force. Famine work terminated with attendance at the Famine Conference at Waltair, except that I carried out a tour near Panem and Dhone, Kurnool district, with the object of ascertaining the condition of agriculturists at the termination of famine operations. In February, at the request of the Inspector-General of Prisons, I was deputed by Government to report on the unhealthy condition of the Rajahmundry Jail. The prisoners seemed to me to be suffering from sub-acute beri-beri. The recommendations then made have, I understand, been acted upon with good results. During March, I proceeded to Tungabhadra and, in consultation with the Local Fund Engineer and Collector, advised as to the erection of a railway inspection plague camp. In consultation with Mr. Moss, the officer in charge of the Public Works Workshops, the supply of temporary steam disinfecting machines for present and future requirements of plague was arranged for, and their effectiveness was tested. In this month also, I inspected the railway inspection plague camp at Arkonam. References, at this period, from Government were of a frequency and nature that it was considered advisable by Government I should not undertake touring until further orders, especially as in the state of uncertainty as to future demands on the funds of Local Bodies, practically no good could result from a series of reports on the routine sanitary requirements of localities.

In the first week of June, I was granted privilege leave for a period of three months. During this time, Major Thompson, D.P.H. (Camb.), acted for me. Towards the end of June, the presence of tophoid fever in Ootacamund having excited public alarm, Major Thompson proceeded there, and rendered a full report for the information of Government. He was then directed to proceed to Hubli, with the object of examining methods for combating plague, and, at the same time, to ascertain how far suitable measures were being taken to guard the frontier stations of this Presidency. He, consequently, visited Hospet, Adóni, and Hubli. In August, plague having appeared at Guntakal, this officer was directed to proceed thither. He inspected the villages of Tiruvallam and Jungalpalli of North Arcot, where plague had been imported from the Mysore Province. He also selected the site for a plague camp at Jalarpet.

I resumed charge of the office from Major Thompson in the first week of September. I found Government had directed that a special inspection of Madras City should be conducted, in reference to an unexplainable increase of mortality under the head of "fever," which it was feared might imply that plague had become epidemic without its being recognized. In conjunction with the Health Officer of the Municipality (Lieutenant Cornwall, I.M.S.), I conducted a house-to-house inspection in various typical localities. This inspection occupied several days; its result is referred to under "Fevers." On the 14th September, I proceeded to the villages of Guntakal and Timmancherla in the Anantapur district, and Chippagiri in the Bellary district. In these, indigenous plague had appeared. This occupied up to the 25th of that month. During September, a Plague Commissioner, Mr. Hammick, I.C.S., was appointed by Government. The

position of this office with respect to the Plague Commissioner is thus defined, in the Government Order directing his appointment (G.O., No. 1122 P., dated 20th September, 1898):—"The Sanitary Commissioner and the officers in his Department shall give every possible assistance to the Plague Commissioner in the conduct of his duties, lending him their assistance and advice to the utmost of their power, and carrying out his orders."

In October, I was directed by Government to supply a scheme for the defence of the City of Madras against plague, in consultation with the President, and subsequently was desired by the Plague Commissioner to report on various sites intended for Municipal plague hospitals and camps, and caste hospitals. During this month, it being found, in respect to the *personnel* for the scheme for maintaining a system of observation in districts "imminently threatened" with plague, that the Certificated Sanitary Inspectors available were insufficient in numbers, with the sanction of Government, I trained and examined 59 men as Temporary Sanitary Inspectors, in referance to the legal and sanitary requirement and methods in respect to plague, and sufficiently as to general sanitation to enable them to grasp the main particulars as to conservancy, water-supply, and the hygiene of dwellings, etc. On November 10th, I returned to the plague-infected areas round Guntakal, and remained there till the 14th. On that date, at the special request of the Collector of South Arcot, I proceeded to Tiruvannámalai, with reference to preparations against importation of plague, at the important annual festival at that place. On the 25th November, I proceeded to inspect the railway inspection station at Hospet, and the frontier road stations in the district of Bellary, as the Bellary district seemed threatened by invasion from H.H. the Nizam's territory. I proceeded to Kopbal in the Nizam's territory, and ascertained the extent to which plague was prevalent. Kamalapur, Hosur, and Taliari ghat was inspected. The town of Bellary was carefully examined in reference to its preparations against plague, and the Municipal Council was met and conferred with. On the 1st December, I proceeded to Bangalore to give evidence before the Plague Commission. On the 16th December, I proceeded to Guntakal, and accompanied the Plague Commission during its inspection. By this time, Mr. Beckley, I.C.S., had been appointed Plague Commissioner; with him I inspected Maddikera, a village in the Kurnool district, where plague had appeared. From thence I proceeded to Gooty, where I met the Union Panchayat and the chief inhabitants of the town in reference to plague preparations. I then inspected the railway inspection camp at Tungabhadra. For the rest of the month, I was occupied in inspecting the plague-infected areas of Peddahotur and Molagavalli. During my inspection of Gooty, Hospet, and Bellary, I undertook plague inoculation.

In accordance with the usual custom in this Presidency, a written report was submitted on the result of each inspection made. In addition to this and routine sanitary and vaccination correspondence, special references for sanitary opinions from Government and local authorities (Collectors, Municipalities, and District Boards) were frequent, and exceptionally large in number.

Practically, Major Bannerman, the incumbent of the office of Inspector of Vaccination and Deputy Sanitary Commissioner, was not available for duty within the Presidency longer than four and a half months, in the aggregate, during the whole year. He, however, during his absence, conducted his usual share of office work, in connection with the Vaccination Department. He continued to attend the laboratory of M. Haffkine for instruction in the making of plague prophylactic serum until 19th April, 1898, when, after a temporary stay in Madras, he was placed at the disposal of the Government of India, for duty in Calcutta. He returned to Madras on the 31st August, 1898, when he was placed on special duty in the town of Madras for the introduction of anti-plague inoculation. He devoted himself to this work with much zeal, and, by means of popular lectures and demonstrations of the method, he did work of great importance in persuading the people to submit to this operation. The people displayed particular confidence in his methods. Three medical officers specially engaged for plague duty were also placed at his disposal, together with one lady Civil Apothecary. With this staff from September to the end of the year, 5,685 cases had been inoculated in the City of Madras.

The endeavour to provide an educated class of Certificated Sanitary Inspectors in this Presidency, in lieu of the so-called "Sanitary Inspectors" of the old type, whose comprehensions of their functions usually extended no further, in sanitary matters, than to see that the conservancy staffs were at their posts, whilst even this useful duty was interfered with by Chairmen requiring of them the duties of tax-collectors, has progressed favourably. Gradually, under the ruling that those who had no more than five years' service must qualify or leave their posts, men who have undergone a fair training in theoretical and practical hygiene have replaced them. Inspection of their diaries (which

form their media of communication with Chairmen of Municipalities) shows that many thoroughly sound suggestions have been excogitated. They now form a distinct factor in the sanitary advance of the Presidency, in that having adopted sanitation as a profession, they have influence amongst the inhabitants in bringing hygienic truths home to them. But, whilst this advance has been secured in municipalities, it seems most unreasonable that Local Fund areas should, with few exceptions, be unprovided with any staff that can deal with sanitary matters. It is to be hoped that the introduction of the revised Local Boards Act (Madras Act No. V of 1884) will secure the necessary funds and organization. The movement has attracted a well-educated and respectable class of young men, and, if nothing occurs "to put back the hands of the clock," the profession of a Certificated Sanitary Inspector in this Presidency should be one which should carry with it much respect. From the class assembled in 1898, not less than 55 matriculates were rejected, on account of the want of sufficient accommodation. In the meantime, there is a tendency for men of still better educational status to undertake sanitary work, who. find themselves debarred from obtaining any qualification other than that of the Licentiate of Sanitary Science of the Madras University, which can only be given to medical men. Whilst I hold that for the post of administrative Health officers, it is essential that a medical education should be undergone, I do not see that it is requisite where executive sanitary work is required. Given a good general education as a foundation, an excellent executive staff could be evolved, by demanding a special course of study from those who have not been put to the unnecessary toil of being qualified as medical men in the first place. In this connection, it must be remembered that there are large numbers of well-educated young men available,* whose services could be secured at a considerably smaller sum than qualified medical men—possessed of the same general educational status. Under these circumstances, I have placed myself in communication with the Director of Public Institution (owing to whose liberal views of matters educational, it has been possible to adapt existing examinations for the requirement of Sanitary Inspectors) with the object of ascertaining whether it is not possible to place before Government a scheme for a higher grade of sanitary executive officers. My suggestion is that candidates should have passed the F.A. examination, and that thereafter they should undergo a course of twelve months' training in subjects that would go towards making the necessary ideal standard. I believe, in this period, it would be possible to impart to them the main truths of theoretical and practical chemistry, bacteriology, physiology, pathology, medical diagnosis (human and veterinary), sanitary engineering, and general sanitation, that would render them valuable acquisitions to the sanitary service of the Presidency. Such a movement demands, on the one hand, that it should be possible to give a special diploma, and, on the other, that Government will insist on Local Fund bodies following the example of municipalities by employing sanitary staffs. My report embodied in G.O., No. 435, Public, dated 17th April, 1897, shows that a Vaccine Institute could be maintained and a complete sanitary and vaccination staff be organized, at an increase over present demand upon municipal income of 1·82 per cent., and a total cost for District Boards that would be covered by 4·85 per cent. upon their incomes.

Up to the end of the year, 64 Certificated Sanitary Inspectors were employed in municipalities, 12 in District Boards, and 69 were on special plague duty. In not a single instance was any complaint received as to the conduct of any Certificated Sanitary Inspector. Of the 98 temporary Sanitary Inspectors on plague duty, it cannot be said that all were equally efficient, or that no complaints were received as to them. Nevertheless, considering the hasty manner in which it was necessary to select and train them, I think they proved of very great utility. Six Certificated Sanitary Inspectors were, after two months' training in the Mysore Government Vaccine Institute, admitted to the Vaccination Department as Deputy Inspectors of Vaccination.

In reference to plague administration, Government adhered to the principles of "Observation" as opposed to quarantine, alluded to in the Personal Proceedings of the preceding year's report.

Following the heavy incidence of plague in the Mysore territory, during the last five months of the year, the disease was imported in 96 separate localities, in a total of eleven districts of this Presidency. In 95 localities, plague was imported 223 times. In 11 of these, importation was repeated from four times to over thrice that number of times. Thus, in Madras† 12 separate instances of importation were detected. Yet, the City of Madras remained free from plague, and in only 20 localities of 5 districts was it reported as indigenous, up to the end of the year. It is fair to argue that the progress of plague,

* During the last five years the Madras Uuiversity conferred the degree of B.A. in 2,120 cases.

† Since the first appearance of the disease in Bombay up to May, 1899, 18 cases have been imported, and have been duly isolated.

so long at least as it is confined to human beings, can be absolutely checked by a correctly worked "surveillance system," backed up by isolation of the sick, and the prompt application of sanitary measures. This is, of course, nothing but what might be expected. But, it is possible to argue that we are not acquainted with how many instances of plague may have been imported, and yet no indigenous plague has followed. This argument is tenable; but, having regard to the certainty with which plague slowly but surely spreads where concealment has been effected, the chances are greatly in favour of the supposition that the system really effectively kept touch of all arrivals from infected areas. I refer to this subject, as the natural tendency is to point to the heavy expenditure necessary for the support of the staff required to work such a method, and, secondly, to show that of so many thousands of cases that were inspected, so few really turned out to be plague. But it seems to me that the chances would have been 100 to 1, that each case detected would, if it had been undiscovered, have led to indigenous plague in the locality concerned, and that, consequently, not only have the people in these places been spared an unnecessarily early visitation from the disease, but they have been spared the loss of lives and money that must follow its appearance, compared to which the expenditure necessary for the staff must be insignificant. It is apt to be felt too that perhaps this escape of localities was not so much due to the precautions taken as to some fortuitous circumstances, depending upon the inability of the plague microbe to accommodate itself to to its environment. This factor undoubtedly does modify the chances of spread and, probably, the virulence of the microbe, but it obviously is very methodical and persevering in its efforts to overcome all difficulties, and it seems to me that, given time and season, there is no place in this Presidency that can be regarded as safe from the possibility of plague importation, and subsequent spread. In no instance has a case of plague been reported as having originated from infected articles received from any locality outside the Presidency. The origin of the disease has always been found to be due to human beings suffering from the disease, arriving from an infected locality. Evacuation of indigenously affected areas has been found, as in all epidemics of this disease that history has recorded, the best sanitary measure. M. Haffkine's anti-plague prophylactic has also its sphere of utility, and Government has done its best to encourage its use. I have, however, consistently opposed advice tendered to Government from time to time by other officers to neglect, or abolish, necessary sanitary measures in favour of solely practising inoculation. A total of 5,685 anti-plague inoculations was performed in the Madras town and 10,532 in the Presidency generally, up to the end of December, 1898. I have not put on record any sanitary experiences in this report as to plague, as I understand these will be dealt with by the Plague Commissioner.

Sanitary Engineering.

In the year under review, which was the ninth since the organisation of the department, the Sanitary Engineer visited fifteen towns and the Assistant Sanitary Engineer twelve, against ten and eight, respectively, in 1897.

The extension of the water-works at Conjeeveram at an estimated outlay of Rs. 50,401 was undertaken during the year, and more than 86 per cent. of the allotment was spent before its close.

Four surveys in connection with water-supply were completed during the year and one drainage and five water supply schemes were prepared and submitted either to the Sanitary Board or to Government. The schemes for improving the water supply of Ootacamund, for the extension of that of Tanjore and for the drainage of the Tanjore Fort were sanctioned by the Government during the year, the first and the third for execution by the Public Works Department, and the second by the Sanitary Engineer. The water-works in Trichinopoly were visited by the Sanitary Engineer and those in Madura, Dindigul and Tanjore by the Assistant Sanitary Engineer, while the pumping stations at Kurnool, Conjeeveram, Dindigul, Trichinopoly, Cuddapah, Tanjore and Madura were inspected and reported upon by the Inspector of Steam Boilers and Prime Movers. Thirteen type designs for sanitary works were prepared by the Sanitary Engineer and his advice was obtained by the Sanitary Board in 73 cases.

Sanitary Board.—The constitution of the Sanitary Board remained the same as in the previous years; but the rules for the conduct of its business were slightly modified by the addition of a rule making it incumbent on Collectors to consult the Sanitary Board whenever, in laying out house sites near railway stations, there arise

special difficulties not provided for in any general rules which the Board of Revenue may issue. The Board scrutinised plans and estimates for 36 Municipal and 78 Local Fund Works, estimated to cost £32,636 in the aggregate. Schemes for the water-supply of Vizianagram, for the extension of the water works at Kurnool and Tanjore and for the drainage of a portion of the Kumbakónam town were examined and laid before Government, and proposals in connection with nineteen other schemes, for which, however, estimates had not been prepared, were considered by the Board. The Board has also approved for issue thirteen type designs, and sent a circular to all local bodies requiring that proposals for repairing and improving tanks hitherto used indiscriminately for bathing, washing and drinking, purposes should include separate provision for drinking purposes so as to secure to the populations concerned a supply of pure drinking water.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1898.

(*Lieutenant-Colonel J. W. Clarkson, I.M.S.*)

General Population.

European and Eurasian Vital Statistics.

The European civil census population of 1891 in the Bombay Presidency, exclusive of Cantonments in quasi-foreign territory, is 18,486. During the year 1898, 246 births and 243 deaths were recorded against 257 and 290 in 1897—a birth-rate of 13·31 per 1,000 against 13·90 in 1897 and a death-rate of 13·14 against 15·69. By sexes 141 males and 105 females were born against 119 and 138 in 1897, and, as regards deaths, 145 males and 98 females died against 170 and 120 in 1897.

The Eurasian census population of 1891 is 8,519. During the year 1898 the births amounted to 123 against 134 in 1897 and the deaths to 169 against 240—the rates being 14·44 per 1,000 against 15·73 in 1897 and 19·84 against 28·17. Of those born, 64 were males and 59 females against 72 and 62 in 1897; as regards deaths, 93 males and 76 females died against 123 and 117 in 1897.

The causes from which deaths among Europeans and Eurasians were recorded are given in the following table:—

Causes of deaths.		EUROPEANS.				EURASIANS.			
		1898.		1897.		1898.		1897.	
		Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.
Bombay Presidency.	Cholera	—	—	10	0·54	—	—	3	0·35
	Small-pox... ...	—	—	1	0·05	—	—	—	—
	Fevers	39	2·11	90	4·87	44	5·16	110	12·91
		14	**·76**	**21**	**1·14**	**23**	**2·70**	**44**	**5·16**
	Dysentery and Diarrhœa.	26	1·41	40	2·16	13	1·53	34	3·99
	Injuries	10	0·54	8	0·43	5	0·59	3	0·35
	Other causes ...	168	9·08	141	7·63	107	12·56	90	10·57
	All Causes ...	243	13·14	290	15·69	169	19·84	240	28·17
		14	**·76**	**21**	**1·14**	**23**	**2·70**	**44**	**5·16**
Cantonments in quasi-foreign territory.	Fevers	2	*	1	*	1	*	1	*
	Other Causes ...	2	*	4	*	2	*	4	*
	Total ...	4	*	5	*	3	*	5	*

* As the population for the cantonments in quasi-foreign territory is not obtainable, the ratio of deaths cannot be worked out. The deaths from plague are included under fevers. Figures in block type denote deaths from plague.

No deaths among Europeans and Eurasians from either cholera or small-pox were recorded during the year 1898. In 1897 there were 10 deaths from cholera among Europeans and 3 among Eurasians. From small-pox there was only one death, and that occurred among Europeans.

In the City of Bombay during the year 1898 there were among Europeans 13 deaths recorded from plague against 20 in 1897. In the collectorate of Poona there was among Europeans one death due to plague. Among Eurasians there were 23 deaths recorded from plague, of which 22 took place in the City of Bombay, and 1 in the collectorate of Poona. In 1897 there were 44 deaths recorded from plague among this community.

Native Population—Vital Statistics.

Births.—In the Presidency of Bombay, including Sind, during the year 1898, there were 582,371 births registered against 629,693 in 1897. The recorded births for the year under report were less by 47,322 than the number registered in the previous year and also less by 70,635 than the decennial mean ending 1897. By sexes there were 302,635 males and 279,736 females against 327,573 and 302,120 in 1897.

The following table shows the number of births registered in each year from 1888 to 1898, their ratios per 1,000, and the proportion of males to females :—

Years.	Population.	Number of Births registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 male Births the females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1888	16,454,414	330,316	304,377	634,693	20·07	18·50	38·57	52·04	47·96	92·15
1889	16,454,414	312,974	287,515	600,486	19·02	17·47	36·49	52·12	47·88	91·87
1890	16,454,414	333,698	307,417	641,115	20·28	18·68	38·97	52·05	47·95	92·14
1891	18,820,346	354,630	328,047	682,677	18·84	17·43	36·27	51·95	48·05	92·50
1892	18,820,346	337,150	313,517	650,667	17·91	16·66	34·57	51·82	48·18	92·99
1893	18,820,346	345,424	318,881	664,305	18·35	16·94	35·30	52·00	48·00	92·32
1894	18,820,346	342,911	317,357	660,268	18·22	16·86	35·08	51·94	48·06	92·55
1895	18,820,346	350,115	324,189	674,304	18·60	17·23	35·83	51·92	48·08	92·59
1896	18,820,346	359,097	332,750	691,847	19·08	17·68	36·76	51·90	48·10	92·66
1897	18,820,346	327,573	302,120	629,693	17·41	16·05	33·46	52·02	47·98	92·23
Mean for 10 yrs.	18,110,566	339,389	313,617	653,006	18·74	17·32	36·06	51·97	48·03	92·41
1898	18,820,346	302,635	279,736	582,371	16·08	14·86	30·94	51·97	48·03	92·43

The recorded birth-rate for the year was 30·94 per 1,000 against 33·46 in 1897, and a decennial mean of 36·06.

The number of births recorded was lower than in the previous year in all the registration districts, except Gujarát. The low birth-rate during the early part of the year was most marked in districts which had suffered from famine and was no doubt due to the breaking up of family life, to reduced stamina leading to lessened fertility and to the reduced number of marriages during the worst period of the famine. The heavy mortality during 1897 and the plague were also, I think, causes of the decrease although no doubt minor ones.

Of the 24 collectorates and districts, the number of recorded births in 1898 was higher than in 1897 in the city of Bombay, Kaira, Panch Mahâls and Karáchi. The remaining collectorates show a decrease as compared with 1897. The city of Bombay, as usual, recorded a low birth-rate. The decennial mean up to 1895 is 19·29. In 1897 the rate per 1,000 was 11·29 and in 1898 13·08, but owing to plague these were exceptional years.

As regards the Central Registration District, the Deputy Sanitary Commissioner remarks: "the birth-rate in 1896 was 39·54; in 1897 33·56 and in 1898 29·50. The fall during these three years has been in every collectorate and is very nearly equal in all, but has been greatest in Ratnágiri. This collectorate is the one in which there has been least famine and plague, but the prevalence of plague in Bombay City has greatly interfered with the earnings of a large number of the population, and this combined with a certain amount of scarcity, no doubt, has led to distress and a lessened birth-rate. The small birth-rate in the Central Registration District during 1898 is no doubt due to the after effects of famine and to a certain extent to the very heavy mortality during 1897."

The Deputy Sanitary Commissioner, Southern Registration District, remarks that the birth-rate has been less throughout the whole district in consequence of emigration on account of famine and plague.

The recorded birth-rates among the urban and rural populations of the Presidency were 24·05 and 31·91 against 24·85 and 34·36 in 1897. Except in the collectorates of Khándesh, Ratnágiri, Bijápur, Kánara, Kaira, Panch Maháls, Ahmedabad and throughout Sind, with the exception of the Upper Sind Frontier, the birth-rates were higher among the rural than in the urban population. The urban rates were in many places greatly affected by the exodus caused by plague, and so also were rural rates in some parts, but not, I think, to so great an extent. In the collectorate of Broach and in the district of the Upper Sind Frontier the birth-rates among the rural and urban populations were nearly the same, 40·48 and 40·55, respectively, in the former, and 26·20 and 26·27 in the latter.

Out of 56 towns in the Presidency, 16 had a birth-rate exceeding 40 per 1,000. Poona, Ahmednagar, Sholápur, Belgaum, Bombay, Alibig, Sátára, Panvel, Hubli and Thána have very low birth-rates. This, in the case of Bombay, Poona, Ahmednagar, Belgaum, Sátára and Hubli, is chiefly due to the decrease in population owing to the exodus caused by plague.

Deaths.—Among the civil population in the rural, town, and cantonment circles in the Presidency, 548,825 deaths were registered during the year 1898. In 1897, 749,916 deaths, or 201,091 more than in 1898, were recorded.

The following statement shows the number of deaths recorded in each year since 1888 :—

1888	...	468,039	1892	...	611,742	1896	...	596,472
1889	...	518,562	1893	...	511,831	1897	...	749,916
1890	...	463,616	1894	...	607,179	1898	...	548,825
1891	...	513,132	1895	...	538,540			

Of the total deaths registered, 288,796 occurred among males and 260,029 among females, against 396,154 and 353,762, respectively, in 1897. The death-rate per 1,000 in 1898 was 29·16 against 39·84 in 1897 and a decennial mean of 30·80. The millesimal rates of males dying to males living was 29·66, and of females dying to females living was 28·63. In 1897 these ratios were respectively 40·68 and 38·95. For every 100 females who died, 111·06 deaths among males were recorded, but these proportions vary considerably in the following collectorates and districts :—

In Thána the ratio of male to female deaths was			113·45 per cent.
„ Bombay	do.	do.	144·48 „
„ Ahmednagar	do.	do.	113·31 „
„ Karáchi	do.	do.	142·35 „
„ Hyderabad	do.	do.	129·17 „
„ Thar and Párkar	do.	do.	115·14 „
„ Shikárpur	do.	do.	114·69 „
„ Upper Sind Frontier	do.	do.	122·16 „

The highest death-rate occurred in the Southern Registration District, which had the misfortune to suffer from both plague and cholera; the former to a considerable extent. All the other districts, except the Western Registration District, were much below the decennial mean, notwithstanding the presence of plague in some of them. The almost total absence of cholera, except in the Southern Registration District, was in favour of a low death-rate; there was no cholera at all in Sind.

Notwithstanding 10,537 deaths from plague in the Central Registration District, the death-rate in this district was considerably below the decennial mean. Plague in Bombay City was the cause of the death-rate of the Western Registration District exceeding the decennial mean, but it only did so to a slight extent.

There were high death-rates very much over the decennial mean in the City of Bombay and in the collectorates of Belgaum and Dhárwár—these were due to plague. In all the

other collectorates, except Thána and Panch Maháls, the rates were below the decennial mean—in most cases very considerably so. The Deputy Sanitary Commissioner, Gujarát Registration District, remarks that the increased death-rates in the collectorates of Broach and Panch Maháls are due to their being affected with plague during the year. The death-rates in 1898 by collectorates ranged from 64·03 per 1,000 in the City of Bombay to 11·04 in the collectorate of Hyderabad. In 1897 the maximum and minimum ratios (58·88 and 15·92) occurred in the same collectorates.

Deaths by sexes.—In the City of Bombay, Broach, Kaira, Panch Maháls, Thar and Párkar and Shikárpur, the recorded death-rates of females were higher than those among males. In Sátára, Kánara, and the Upper Sind Frontier, the death-rates of males and females were about equal. In the remaining collectorates the death-rates of males exceeded those of females. In 1897 the female death-rates exceeded those among males in the City of Bombay, Shikárpur, the Upper Sind Frontier, and Thar and Párkar.

Deaths by ages.—The figures given below show the total deaths in 1898 under different ages, as also the ratios per 1,000 living, calculated on the population of each age-period enumerated at the Census of 1891 and the percentage of total deaths :—

Age-period.	Population according to Census of 1891.	Number of deaths.	Ratio per 1,000 of population.	Percentage on total deaths.
Under 1 year	680,472	99,590	146·35	18·15
1 and under 5 years	2,178,646	90,732	41·65	16·53
5 and under 10 do.	2,615,588	33,696	12·88	6·14
10 do. 15 do.	1,820,754	24,889	13·67	4·54
15 do. 20 do.	1,470,976	19,102	12·98	3·48
20 do. 30 do.	3,410,817	55,217	16·48	10·06
30 do. 40 do.	2,765,949	55,326	20·00	10·08
40 do. 50 do.	1,841,976	46,115	25·04	8·40
50 do. 60 do.	1,117,120	42,298	37·86	7·71
60 and upwards	918,048	81,860	89·17	14·91
Total	18,820,346	548,825	29·16	100·

As compared with last year the table shows that there has, in the present year, been a decrease in the percentage of deaths under 5 years and an increase between 20 and 60, which is most marked between the age of 20 and 40. These variations are no doubt due to the almost complete absence of cholera and famine, and to the increase in plague during the present year. The variation is most marked in the decrease of deaths below 5, and this would be no doubt due to the decrease of famine. The absence of cholera would tend to reduce adult deaths, but this has no doubt been counteracted by the increase in plague, which would tend to swell them considerably.

Deaths by causes.—The subjoined table shows the deaths in 1898 arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1897 and with the decennial mean. The "causes of death" will be briefly noticed in the next section :—

Causes of deaths.	Mean for 10 years, 1887–1896.		1897.		1898.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	28,672	1·58	57,109	3·03	4,368	·23
Small-pox	3,720	·21	3,835	0·20	1,834	·10
Fevers	384,710	21·24	452,596	24·05	302,515	16·07
			46,944	**2·49**	**86,191**	**4·58**
Dysentery and diarrhœa ...	42,783	2·36	85,966	4·57	56,789	3·02
Injuries	6,029	·33	6,907	0·37	6,984	·37
Other causes	91,989	5·08	143,503	7·62	176,335	9·37
All causes	557,903	30·80	749,916	39·84	548,825	29·16
			46,944	**2·49**	**86,191**	**4·58**

N.B.—Figures in thick type denote deaths from plague which have been included under "Fevers."

The death-rate for the year was 29·16 and the decennial mean is 30·80. It is therefore seen that notwithstanding the presence of plague, the year—judged by the number of deaths—was a healthy one. If there had been no plague the year might have been described as a healthy one up to the end of April, a very healthy one from April to October, and about a normal one from then up to the end of the year. As things were, plague reduced the first period to a normal one, affected the middle very little, but converted the last into a very unhealthy one. Of course, this is taking the Presidency as a whole, otherwise, districts varied greatly. Compared with the previous year there is a great improvement as shown by the rates 39·84 for 1897 and 29·16 for 1898. Last year the the death-rate was greatly increased by the effects of famine, by a very heavy cholera mortality, and by plague, and was considerably above the decennial mean (39·84—30·80).

The recorded death-rates among the urban and rural populations of the Presidency were, respectively, 47·88 and 26·55 per 1,000 of population against 56·73 and 37·49 in 1897. Among the rural population the death-rates were higher than in the urban population in the collectorates of Dhárwár and Kánara where the rural death-rates exceeded the urban by 8·13 in the the former and 8·43 in the latter.

Chief Diseases.

Cholera.—During the year 1898 there was practically no cholera except in the Dhárwár collectorate, and Sind for the second year in succession was entirely free. There were in all 4,368 deaths recorded compared with 57,109 in 1897, and with three exceptions this is the lowest record during the last 20 years; the year 1897 gave by over 15,000 the highest record during the same period. The ratio per 1,000 was 0·23 as compared with 3·03 for last year and a decennial mean of 1·41. Of the 4,368 deaths no less than 4,054 occurred in the Dhárwár collectorate. Bombay City gave a few deaths every month, but the total for the year amounted to only 104. As already mentioned Sind was entirely free, and 4,054 deaths occurred in the Dhárwár collectorate; the Poona collectorate gave one death, as did also Ahmedabad collectorate; the collectorates of Sátára and Ahmednagar gave 2 each, the collectorates of Bijápur and Sholápur 3 each, Thána collectorate 7, Kolába collectorate 15, Kánara 79, and Belgaum collectorate 97.

In December, 1897, there were 121 deaths reported from eight districts. These districts were Sholápur, Khándesh, Ratnágiri, Kánara, Thána, Bombay City, Kolába and Dhárwár. It is not necessary to follow the disease month by month as, with the exception of the City of Bombay, Belgaum, Dhárwár and Kánara, there were only scattered cases at intervals. The City of Bombay has already been disposed of: Belgaum collectorate had one case in February, and then a few cases every month from May to the end of the year, but the total only amounted to 97. In the Dhárwár collectorate there were 4,054 deaths, and these were spread over every month of the year; the disease increased in April, reached its maximum in August, lingered in September and October, and died out in December. In Kánara there were deaths in April and May, when more than half the total (79) occurred, and the remainder took place in July, August and September.

By seasons: 2,580 deaths occurred in the rainy season of 122 days; 1,003 in the hot and dry season of 61 days; 348 in the cold season of 121 days, and 437 in the hot and damp season of 61 days.

Out of 220 rural circles 27 were affected by cholera during the year. In 18 of these the death-rate was below 1 per 1,000 of population. As already mentioned, the disease was almost exclusively confined to Dhárwár. Out of 13 tálukas of this collectorate 8 were affected.

Out of 56 town circles 14 were affected during the year. Of these, 7 had only one death each and 2 had two each. There was no cholera in any of the cantonments.

Out of 7,751 villages in the districts affected by cholera, 324 or 4·18 per cent. were affected during the year. The highest percentage (21·80) took place in the Dhárwár collectorate, where out of 1,303 villages 284 were affected. In the collectorate of Belgaum the percentage was 1·77, while in the remaining affected collectorates the percentages were below 1 per cent.

Small-pox.—There were 1,834 deaths from small-pox (946 males and 888 females) against 3,835 in 1897 and a decennial mean of 3,720. The year's mortality was the lowest on record with one exception during the last twelve years. The Western Registration District was the most affected; after it came the Southern and Central Registration

Districts ; Sind was very slightly affected, and the Gujarát Registration District gave only 10 deaths. The deaths were 2,001 less than in the previous year, and the ratio per 1,000 was 0·10 against 0·20 last year and 0·21, the decennial mean. These figures may be considered very satisfactory, and they testify to the exceedingly good vaccination work which now for some years has been done in the Presidency. After the experience of the famine year of 1877 and the following year, when 27,369 and 4,475 deaths from small-pox were recorded, it is very satisfactory to be able to state that, notwithstanding much better registration, the famine year of 1897 and the following year gave only 3,835 and 1,834 deaths from the same disease. This result is chiefly to be attributed to the progress vaccination work has made since the former period.

As regards collectorates, there was an increase in Násik and Thána in the Western and Bijápur and Kánara in the Southern Registration Districts. The highest death-rate 0·42 occurred in Khándesh and the lowest 0·01 in Ahmedabad. There was only one death in each of the following collectorates :—Surat, Kaira, and Panch Maháls : Ratnágiri, Broach and Shikárpur were entirely free.

According to age, 27·59 per cent. of the small-pox deaths occured amongst infants under one year of age, whilst 51·69 per cent. took place amongst children over 1 and under 10, the remaining 20·72 being among persons over 10 years of age.

Fever.—There were 302,515 deaths registered under the heading "fever"—161,213 males, and 141,302 females. This shows a decrease of 150,081 as compared with the previous year : the decennial mean is 384,710. The above figures include deaths from plague ; excluding this disease there were 216,324 deaths ascribed to fever as compared with 405,652 in the previous year, and a decennial mean of 379,806. With the agency at our disposal for the registration of deaths, and in a country where so many diseases are by the people called fever, it is inevitable that many diseases must be returned under the head of "fever" which do not rightly belong to this heading. This has always been the case, and although these fever deaths cannot be relied on as being all due to fever, they can, when taken for a number of successive years, give an indigation as to the prevalence or otherwise of the common fevers of the country. The carrying out of plague measures in some of the towns of the Presidency has led to very much more accurate registration in them. Some municipalities are, I think, improving in this respect, and it is to be hoped that this may continue, and that in time it may be possible not only to obtain more accurate registration, but to add to the headings at present in use.

The death-rate under the heading "fever" was 16·07 per 1,000 compared with 24·05 for the previous year, and a decennial mean of 21·24, and this notwithstanding the fact that deaths from plague are included under the heading. In only one district was the rate higher than the rate last year and the decennial mean, and that was in the Southern Registration District, and was undoubtedly due to a high mortality from plague in the collectorates of Dhárwár and Belgaum ; in all the other districts it was exceptionally low, especially in the Central. If it had not been for the large number of plague deaths, the rate for the Presidency would have been very much lower. For the Western Registration district the rate was very much increased by the large number of plague deaths in Bombay. The rate in Ahmednagar collectorate was very low, and is more than one quarter below the decennial rate. This would almost lead one to suppose that deaths usually registered under "fever" are being entered under some other head, but the rates under "dysentery and diarrhœa" and "other causes," under which cases would fall if excluded from "fever," are in the former only very slightly increased, and in the latter, although doubled, do not show a greater increase than in a great many other collectorates whose decreases under "fever" are not nearly so great as in Ahmednagar.

There was a rise in all districts in the number of deaths returned under "other causes," but even if the increases were added to the "fevers" it would not, except in the case of the Southern Registration district, make any of them over the decennial mean, and considering this and the low rate under "fever" and the fact that a large number of plague deaths are included, it may be taken that, as regards the common fevers of the country, the year was a healthy one, and, also, that no disease which would be likely to be returned under the heading "fever," except plague, was at all widely distributed or fatal.

In spite of the nearly double increase in the plague mortality the number of deaths in each month during the year is less than in the corresponding month of the previous year, and, excepting October and November, is less than the decennial mean. In June the lowest mortality for the year was as usual reported, and in July a rise took place which reached its maximum in October ; November gave nearly the same number of deaths as

October, but in December there was a decided fall. Excluding plague deaths the number every month was considerably less than the corresponding months of last year and of the decennial mean, and except that the numbers were very low the monthly variations as compared with the decennial mean were normal.

Dysentery and Diarrhœa.—Dysentery and diarrhœa caused the deaths of 30,256 males and 26,533 females, or a total of 56,789 persons against 85,966 in 1897, and a decennial mean of 42,783—a decrease of 29,177 against the last year, but an increase of 14,006 over the decennial mean. The deaths ascribed to "dysentery and diarrhœa" during the ten years preceding 1897 showed only very slight variations, but in 1897 the deaths due to these diseases showed a considerable increase and amounted to nearly double that of any of the ten years already mentioned. The increase has been continued during the present year, and, although much smaller, the total is still considerably over any of the ten years previous to 1897. The rate (3·02) although still high was lower than in the year 1897 (4·57), but was still over the decennial mean (2·36). The increase as last year is chiefly in the Western and Central Registration districts and is most noticeable in those parts lately affected by famine, with the exception of Bijápur which showed a decrease as compared with the decennial mean. The collectorates of Násik, Poona, Sholápur and Sátára, which last year had a very high rate, still show a rate considerably over the mean, and Sholápur as last year continues to head the list, although not so markedly. All these collectorates suffered from famine in 1896–97 and some to a certain extent in 1898. Sholápur, which shows the highest rate in 1897 and also in 1898, was the one most severely affected by the famine as well as the one in which it continued the longest. In my opinion the prevalence of these diseases is chiefly due to the after effects of the famine. The Southern Registration district, which last year showed an increase over the decennial mean, has this year fallen below it. The variations in the Registrations districts of Gujarát and Sind are very small and call for no remark.

Injuries.—During 1898, 3,973 males and 3,011 females, or a total of 6,984 persons met with violent deaths. The mortality from these causes is more by 77 than that reported in 1897.

Of these 3,004 occurred from drowning, 1,451 resulted from snake-bites, 660 from wounding, 223 from hanging, 115 from poisoning, 79 from attacks by wild beasts, and 1,452 from other causes.

Other Causes.—The recorded deaths from causes other than those specified number 176,335, of which 90,033 occurred among males and 86,302 among females. The total for 1897 was 143,503, so there is an increase of 32,832. Under this head all deaths are included which cannot be classed under cholera, small-pox, fever, dysentery and diarrhœa, or injuries. They have been increasing gradually for the last ten years, and are now more than double what they were ten years ago. The increase became more pronounced in 1897, and this has been continued during the present year. At first sight this late increase would at once be put down to increased accuracy in registration owing to famine and plague operations, but the subject is not quite such an easy one as at first appears, as there are other things which influence the rates.

Sanitary Works.

All available information under these sections has been thrown in a tabular form, and will be found in Appendices IV. and V.*

There were 166 Municipalities (compared with last year (167), Matar in Kaira and Pussesavli in Sátára district have been abolished, and Kharda in Ahmednagar newly established) in the mofussil, with a population of 2,231,254 souls and an income of £355,080. Out of this income £174,802, or 49·23, were allotted for sanitary works, and out of this allotment £161,790, or 92·56 per cent., were spent. Out of the total expenditure, £70,052, or 43·30 per cent., were spent on conservancy; £34,534, or 21·34 per cent., were spent on improvement of water-supply; £8,129, or 5·02 per cent., on improvement of town sites; £2,781, or 1·72 per cent., were spent on construction and repairs of markets and slaughter-houses; £2,119, or

* Not reprinted.

1·31 per cent., were spent on sanitary arrangements during fairs and festivals, and £44,177, or 27·31, were spent on other sanitary objects, including construction and repairs of tanks, &c.

The Bombay Village Sanitation Act of 1889 has been introduced in 17 other villages during the year 1898, making a total of 299 since the introduction of the Act in the year 1895. At Andersal in the Násik collectorate the Act has been suspended for the present. In the village of Mirajgaon in the Ahmednagar collectorate the Sanitary Act was introduced in 1895, but the people of the village having objected to the establishment of the sanitary committee the proclamation was cancelled in 1896 in accordance with Clause 3 of Section 6 of the Act. In May 1898 the Act was re-introduced into the village and a committee established under Part II. without funds.

Personal Proceedings and General Remarks.

The year 1898 has witnessed a continuance of the plague in the Bombay Presidency and is chiefly remarkable for its spread in the Southern Marátha Country. A brief account of its progress in the Presidency is appended.

The Sanitary Department has been much disorganised during the year owing to the Deputy Sanitary Commissioners and Inspectors being called away by Government for other purposes and no men being supplied to take their places.

A mixed Commission consisting of three medical men from England and two members of the Indian Civil Service, with a secretary, also a civilian, was appointed and commenced its work on 28th November, 1898.

The Committee was directed to inquire into—

1. The origin of the different outbreaks of plague.
2. The manner in which the disease was communicated.
3. The effect of curative serum.
4. The effect of preventive inoculation.

All purely medical questions.

The control of the plague operations was, during the year, under the direction of a member of the Indian Civil Service who was termed the Plague Commissioner.

In the course of the year 4 Native States have been permitted to maintain their own vaccination establishments. This means that they appoint their own vaccinators and supervising staff, and all that the Sanitary Department have to do with them is that the Sanitary Commissioner and his Deputies can inspect the work from time to time. This will mean very little control over the vaccinators, as, owing to the large areas in their charge, Deputy Sanitary Commissioners cannot often inspect, and the vaccination will deteriorate.

The camps which had been kept open to afford relief to workers (two in the Sholápur and one in the Poona district), till the harvest was assured and work was obtainable, were closed finally on the 28th October, 1898.

The City of Bombay Improvement Trust Bill was passed into law, and under it a Board has been appointed on which three medical men have seats. The first meeting was held on 24th November, 1898. It will probably take some time before any results are arrived at, and, in my opinion, one method of preventing overcrowding would be to prohibit the building of any more factories or mills or any concern employing a large amount of labour in the Island of Bombay, unless the owner or company will put up sufficient and suitable accommodation for their employés, not necessarily in the compound, but within reasonable distance.

Last year a very important sanitary measure was directed to be adopted by Government in Government Resolution No. 4512, in the General Department, dated 19th August, 1898, and the introduction of a "Village Sanitary Inspection Book" was ordered in such villages only as may be approved by the Commissioner of the Division in which they are situated. This measure, which will result in great sanitary progress, should be extended to all villages.

It is to be hoped that Government will bear in mind the need of strengthening the Sanitary Department and add to the staff a Bacteriologist as soon as funds permit, and take the first steps towards founding a Sanitary Institute of Public Health on the lines suggested in my report for 1897.

If the latest methods of dealing with sewage are to make any headway and secure public confidence, a bacteriologist to keep on experimenting and controlling operations, will be absolutely necessary.

Owing to the regulations for combating plague, the registration of deaths has been rendered much more accurate, and this increased accuracy should be kept up even when the plague has passed away. Also a good deal can be done to encourage the registration of births by refusing to accept, after the lapse of a certain number of years, declarations before Magistrates and horoscopes as evidence of age.

Plague.

The figures shown are from returns received in this office and do not tally with returns elsewhere published. In the general returns the deaths are included under the heading "Fever." At the end of 1896 there had been a total of 2,909 attacks and 2,086 deaths from plague, 61,093 attacks and 46,944 deaths were recorded during 1897 and 110,369 attacks and 86,191 deaths in 1898 ; the table on the opposite page gives the progress of the disease by months in each collectorate for the year under report.

Khándesh.—Plague prevailed to a limited extent up to May, the greatest mortality (79) being in February. From May up to November there was only 1 attack. In November and December there were 35 attacks and 21 deaths. No town circle was affected. The total for the year was 16 villages affected, 289 attacks and 230 deaths.

Násik.—The outbreak, which had begun in August 1897, reached its maximum (354 deaths) in January and was on the decline in February. After that month the mortality fell rapidly and the collectorate was free in May. There were a few cases in July, and in August the deaths amounted to 269 ; they increased during September and declined during October and November, but in December there was a slight rise, and the month showed a mortality of 161. The town circles of Násik and Sinnar and Málegaon town suffered during the first three months of the year—the latter rather severely during January. In all 71 towns and villages were affected, and there were 2,699 attacks and 1,951 deaths.

Thána was affected during the whole year. In January the disease was on the increase, and this continued until May, when there was a fall, which, however, only lasted during June. In July there was a large and sudden increase in the mortality, and the deaths continued to increase during August, but in September there was a substantial fall, which continued during October and November ; in December there was a slight rise. The mortality was heaviest during the latter half of the year. There were a few cases in nearly every month of the year in the town circles of Thána and Bándra ; the former had most in August, September and October, and the latter from April to September. Bhiwndi town was severely affected ; the disease commenced in April and ended in October, and was at its height in August : there were in all 1,789 cases and 1,261 deaths. The total for the year was 95 towns and villages, 5,374 attacks, and 3,235 deaths.

Bombay City.—As in 1897 the disease was prevalent during the entire year. In 1897 it had reached its minimum in July, but from that month it showed an increase up to the end of the year ; this, although slight up to the end of November, was more decided during December and in January was very marked. The maximum deaths (4,973) were reached in March, in April there was a fall to more than half this number, and in May and June there was a very considerable fall. In July the mortality increased and continued to do so until October, the greatest number of deaths during this period being (709) during the latter month ; it fell greatly in November but rose again in December. The lowest mortality was in June, and by far the greatest number of deaths occurred during the first half of the year. The total for the year was 19,863 attacks and 18,130 deaths ; but there is very little doubt that many cases and deaths escape registration.

Kolába.—There was a little plague in Kolába up to July. The highest mortality being (238) in March. No cases occurred in July, only 1 case in August, and very few in September, October and November, and these were chiefly imported. In December there were 93 deaths. In all there were 46 towns and villages affected and 779 attacks, and 654 deaths.

No.	Collectorates.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total.		Number of Towns and Villages affected by Plague.
		Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	
1	Khándesh	63	55	99	79	80	68	11	7	—	—	—	—	—	—	—	—	1	—	—	—	24	8	11	13	289	230	16
2	Násik	420	354	203	153	194	60	20	16	—	—	1	—	8	1	316	269	671	479	503	339	172	119	191	161	2,699	1,951	71
3	Thána	311	97	549	143	654	261	653	363	241	199	187	137	720	456	1,182	855	357	277	148	141	114	103	258	203	5,374	3,235	95
4	City of Bombay	2,920	2,934	4,750	4,498	4,780	4,973	2,613	2,171	811	524	371	150	336	263	643	543	921	684	867	709	271	209	580	472	19,863	18,130	1
5	Kolába..	95	68	161	125	269	238	79	73	32	25	4	5	—	—	1	—	10	7	8	5	16	15	104	93	779	654	46
6	Ahmednagar..	171	152	110	102	34	28	1	1	—	—	—	—	1	1	1	1	—	—	17	10	30	23	33	15	398	333	12
7	Poona	646	436	206	137	94	42	23	13	6	4	2	—	4	1	39	29	103	61	462	328	281	239	76	65	1,942	1,355	60
8	Sholápur	746	497	474	370	116	80	18	9	—	—	1	—	97	62	203	77	123	65	219	166	106	89	185	142	2,288	1,557	80
9	Sátára	1,125	778	540	402	338	137	117	96	148	120	115	74	259	183	558	300	1,201	822	2,463	1,987	1,706	1,459	770	560	9,340	6,918	220
10	Ratnágiri	16	13	43	27	199	146	201	167	9	11	—	—	—	—	1	1	10	7	2	1	1	1	—	—	482	374	33
11	Belgaum	402	228	250	174	257	129	168	110	153	116	281	211	1,124	853	2,313	1,638	4,159	2,958	7,268	5,352	4,355	3,227	1,817	1,305	22,547	16,301	183
12	Dhárwár	5	1	3	1	7	5	9	7	33	22	118	81	585	319	2,976	2,324	6,545	5,304	9,870	7,766	9,360	7,784	4,983	4,150	34,494	27,764	120
13	Bijápur	—	—	13	4	11	5	1	—	—	—	—	—	—	—	—	—	32	21	296	247	422	288	598	414	1,373	979	49
14	Kánara..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13	8	10	11	11	8	42	32	76	59	8
15	Surat	684	555	815	577	560	471	188	153	87	51	110	71	376	274	344	245	143	114	38	28	18	12	3	1	3,366	2,552	95
16	Broach	3	2	—	—	1	1	7	4	1	1	2	2	23	13	209	151	162	118	83	61	37	22	52	49	580	424	19
17	Kaira	26	26	36	17	10	7	9	3	1	1	—	—	—	—	7	4	23	13	34	28	140	112	326	234	612	445	28
18	Panch Mahális	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	52	35	55	49	164	117	272	201	15
19	Ahmedabad	6	3	2	2	—	—	1	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	10	6	3
20	Karáchi	7	4	—	—	3	—	899	579	2,076	1,684	388	272	138	64	98	78	25	14	21	13	10	10	8	4	3,583	2,722	33
21	Hyderabad	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	1
22	Thar and Párkar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	Shikárpur	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	Jacobabad	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total for the Presidency ..	7,646	6,203	8,254	6,811	7,607	6,651	4,928	3,773	3,599	2,759	1,581	1,003	3,671	2,490	8,892	6,515	14,500	10,952	22,361	17,227	17,129	13,777	10,201	8,030	110,369	86,191	1,188

Ahmednagar.—In January there were 152 deaths, after which they fell rapidly until in April the district was practically free and continued so until October, in which month, and until the end of the year, there were a few deaths, but they never amounted to more than 23 in any one month. Ahmednagar town circle was affected during the early months of the year; there were 101 deaths in January, but after this the disease rapidly declined. The totals for the year were 12 towns and villages, 398 attacks and 333 deaths.

Poona.—The disease, which had prevailed considerably, chiefly in the City of Poona, during the latter part of 1897, had in January shown a great and sudden fall, which continued until in May the district was practically free, and remained so until August, in which month there was a slight rise, which increased in October and November, but fell in December; during this period the highest mortality (328) was in October, there were 65 deaths in December. In January, Poona City was at the end of a severe epidemic which had commenced in August; during the succeeding month the epidemic rapidly declined, and the city was free at the end of April. In all there were 60 towns and villages affected, and 1,942 attacks and 1,355 deaths during the year.

Sholápur.—Plague had commenced in September, 1897, and had continued to increase until the end of the year. In January there was, as in the Poona district, although not to the same extent, a great and sudden fall, which continued until in April there were only 9 deaths, and in May none. In June the district was practically free, but in July the deaths rose, continued to do so in August, and fluctuated up to the end of the year. The greatest number of deaths (166) during this period was in October. Sholápur town was slightly affected during January and February, this was the end of a sharp outbreak which had occurred towards the end of 1897. The totals for the year were 80 towns and villages, 2,288 attacks, and 1,557 deaths.

Sátára.—This collectorate was affected throughout the year. The disease which had commenced in July, 1897, was on the decrease in December, and this decrease continued into the present year and reached its minimum (96) in April. The mortality then rose, but showed no very great increase until August, when the rise became more considerable, and in October had reached the maximum (1,987); it fell in November and December, and in the latter month had fallen to 560. All the tálukas except Malcolm Peit were affected, but nearly one-third of the deaths recorded were in the Sátára táluka. Sátára town in January was at the height of an epidemic which had commenced in October, 1897; in February the mortality fell considerably, and in May the town was free from the disease, but there was a slight epidemic in the latter part of the year. In the whole collectorate 220 towns and villages were affected, and there were 9,340 attacks and 6,918 deaths.

Ratnágiri.—In the first half of the year there was some plague, but the latter half was practically free. The highest mortality (167) was in April. There were 33 towns and villages affected, and 482 attacks and 374 deaths occurred.

Belgaum.—With the exception of the City of Bombay and Dhárwár this was the collectorate which suffered most during the year. The disease commenced in October, 1897, in December it had reached the maximum mortality of that epidemic (275), and then began to decline gradually until June, in which month it showed a rise, which continued until the maximum (5,352) was reached in October; a fall then set in, which continued up to the end of the year. Belgaum town was affected throughout the year; in January an epidemic which had commenced in October was at its height, but in February there was a considerable fall, which continued; cases, however, kept on occurring, and they considerably increased in August, and the town went through a much more severe epidemic than the previous one. The totals were 183 towns and villages affected, and 22,547 attacks and 16,301 deaths.

Dhárwár.—In 1897 there were a few cases every month from October to the end of the year, and this continued up to June of the present year, in which month there was a rise in mortality, which continued during July and August, and in September was very pronounced. The maximum (7,784) was reached in November, and it was not until December that there was any decided improvement. This collectorate was the one which suffered most severely in the whole Presidency. Belgaum had more towns and villages affected, but the mortality was much greater in Dhárwár and was 26·4 per 1,000. In Dhárwár town the disease commenced in July, reached its maximum in October, and in December had almost entirely disappeared. There were 120 towns and villages affected, and there were 34,494 attacks and 27,764 deaths.

Bijápur.—There were a few deaths during February and March, but none between that month and September; in the latter month the disease recommenced and gradually increased up to the end of the year. There were 414 deaths in December. The totals were 49 towns and villages affected, and 1,373 attacks and 979 deaths.

Kánara.—There was no plague until August, when 8 towns and villages became affected, and there were 76 attacks and 59 deaths distributed over the remainder of the year.

Surat.—In this collectorate the plague was present in every month of the year, both in 1897 and 1898. In January the disease was rising, and the maximum (577) was reached in February, after which the mortality declined until May. In June and July it again rose; in August there was a slight decrease, and after that a rapid one, until at the end of the year the collectorate was practically free. In January the City of Surat was in about the middle of an epidemic which was on the decline; there were, however, a good many cases up to the end of March, but during April the disease died out. In all there were 95 towns and villages affected, and 3,366 attacks and 2,552 deaths.

Broach.—There were only a few scattered cases until July, when there was a slight increase, followed by a larger one in August; however, this was not maintained beyond September, and the mortality declined with fluctuations up to the end of the year. The town of Broach was slightly affected during the latter part of the year, as was also Anklesvar. There were 19 towns and villages affected, and 580 attacks and 424 deaths.

Kaira.—There were a few cases up to June, but they were all imported, and no local cases occurred until September. From that month the disease increased up to the end of the year, but the greatest number of deaths in any one month amounted to only 234. There were 28 towns and villages affected, and 612 attacks and 445 deaths.

Panch Mahâls.—The disease appeared in October, and increased up to the end of the year, but there were in all only 272 attacks and 201 deaths in 15 towns and villages.

Ahmedabad.—There was no indigenous plague in this collectorate, only 10 imported cases and 6 deaths being reported.

Karáchi.—In Sind the disease was, with the exception of 2 imported cases in the Hyderabad collectorate, exclusively confined to the collectorate of Karáchi, and the only part of this district which was affected, with the exception of 8 cases at Kotri, was the town of Karáchi, in which there were 3,253 cases and 2,543 deaths. There were in addition 322 cases at various places in the collectorate, but they all originated in Karáchi town. The outbreak in the town of Karáchi was sudden and sharp; it commenced in April, and in May had reached its height. In June there was a considerable fall in mortality, and this was very much more marked in July and August, but a few deaths occurred monthly up to the end of the year.

Hyderabad.—In this collectorate the only cases reported were 2 imported ones.

In the whole Presidency there were 86,191 deaths from plague, and 1,188 towns and villages were affected, as compared with 46,944 deaths and 912 affected towns and villages in 1897. The number of deaths from plague in 1897 was nearly exactly the same as the cholera deaths during the worst cholera year in the previous 19 years. The heaviest mortality from cholera during the last 20 years occurred in the year 1897, but the plague deaths during 1898 exceeded this by 29,082.

The parts most affected were the collectorates of Dhárwár, City of Bombay, and Belgaum, and the rates of plague deaths per 1,000 in them were 26·4, 22·4, and 16·1 respectively. Sátára came next with a rate of 5·6, and then Karáchi, Thána, and Surat with rates which ranged from 4·8 to 3·9 per 1,000; Násik and Sholápur had rates of 2·3 and 2·08 respectively, the rates of the remaining affected collectorates were much lower. As already mentioned, the only parts of Sind which returned indigenous cases were the towns of Karáchi and Kotri; the former suffered severely, but the latter gave only 8 cases. Except for a few imported cases the collectorate of Ahmedabad was entirely free. With the foregoing exceptions all the collectorates in the Presidency were more or less affected. The rate per 1,000 for the various Registration Districts were as follow:—Western 5·35, Central 2·09, Southern 13·65, Gujarát 1·17, and Sind 0·95.

In January there were 6,203 deaths, and during February and March there were much about the same number. In April the deaths fell considerably, and continued to fall until the minimum (1,003) was reached in June. They rose a little in July, and in August and September there was a more distinct rise, and in October they reached the

maximum (17,227), after which there was a fall in November, and this continued and was very much more marked in December.

The year 1898 was remarkable for :—A very low birth-rate up to the end of July, one considerably above the average for the last four months of the year, and a rate for the whole year much below the normal ; a very low cholera mortality ; a largely increased plague mortality ; and a low death-rate from diseases—excluding plague—registered under the heading "Fever." Excluding plague, the year was one of the healthiest during the last 11 years. Prices of the chief food-grains, although still somewhat high in the Deccan, were very much lower than in the previous year. In Khándesh they were, as regards some food-grains, lower than the average, and this was also the case in Gujarát. The low death-rate, the increasing birth-rate, and the reduced mortality from dysentery and diarrhœa show that during the year the people were rapidly recovering from the effects of the famine of the previous year.

Report of the Sanitary Board for the Year 1898.

Preliminary.—Owing to the expenditure incurred by municipalities in connection with the plague, and to their reduced incomes from the restriction of trade due to the plague, almost every municipality has shelved the consideration of all important sanitary works ; and unless Government come to their assistance by relieving them of the whole, or of the greater part, of the debts they have incurred in connection with plague, it is certain that this stagnation will continue for many years. In every district municipality there are a certain number of members who are opposed to progress, and to any taxation, except in the cause of schools ; and their influence is materially strengthened when the municipality is already in debt. We would also suggest that the Government should deal more liberally with these municipalities in the way of loans for important sanitary works. In the North-West Provinces, Punjab, and Madras, a municipality can always not only get a Government loan for a sanctioned work of this nature, at 4 to 4½ per cent., for 20 or even 30 years, but also in most cases they get a large grant-in-aid ; whilst in this Presidency these municipalities are now forced to go to the open market, where 6 to 12 per cent. is demanded ; and even the lower of these rates is prohibitory, with their small means. Moreover, no municipality in this Presidency has ever got a grant-in-aid, although it is known that without this material assistance few of the important sanitary works in other provinces could have been carried out. Such an assistance is a powerful lever in inducing a municipality to agree to the extra taxation required for these works ; and we earnestly hope that the Government may be pleased to assist future schemes in this Presidency, as they are assisted in other provinces. Under the continued pressure of the plague authorities, the general state of improved cleanliness, noticed in the last report, has been maintained.

Shikárpur.—Nothing has been done here ; and, in fact, the municipality passed a retrograde resolution stopping the construction of the system of gutters by which the waste water from the numerous wells in the crowded town should be removed outside.

Sukkur.—Nothing has been done here. The water-works engines have been much neglected, and serious repairs will soon be necessary.

Hyderabad.—With very great difficulty the municipality were induced to order the urgently wanted new engines for the river pumping station at Giddu, by means of a temporary loan from Government. The new engines are to be triple expansion Worthington's ; and they are expected to begin working during the hot season. Plans and estimate for the remaining portion of the water-works, as indicated in last year's report, have been prepared by the Sanitary Engineer ; and as the finances of this municipality are fairly good, it is to be hoped that they will take up these items in due course ; but the management of this municipality is not good. The municipality have recently got plans and estimates for a complete and satisfactory drainage scheme, but this has now been shelved.

Ahmedabad.—The municipality have recently got plans and estimates from Mr. Baldwin Latham for the completion of their drainage scheme, at a cost of about 16 lakhs (£107,000), exclusive of house-connections. The position of the proposed pumping station has had to be altered, and several details have had to be revised ; and the municipality are considering about the engagement of a special engineer, competent to revise the estimates,

and to superintend the work. They have applied for permission to raise a loan of 8 lakhs (about £53,000), and are prepared to proceed with the works as soon as Government have approved of the plans. The experiment of pumping some of the sewage to the lands under the Chandola tank has been successful. These fields are able to get plenty of irrigation water, and the sewage provides them with the necessary manure at a small cost. If the land in the vicinity of the existing small sewage farm can be got at a reasonable cost, it is proposed to give up the 300 acres got from Government about two years ago, at a distance of 3 miles from the city, as the cost of the rising main to that site will be heavy.

Kaira.—The water-supply of this town is a serious matter, as most of the wells, and the adjoining river Watrak for at least the worst portion of the year, only give brackish water. The Sanitary Engineer recently had a series of levels taken, and sketched out proposals for a scheme costing about £5,300. to supply 11,000 people, which is now under consideration by the local authorities.

Mehmadabad.—This town is 7 miles east of Kaira, and suffers under similar difficulties as to its water-supply. Similar measures were taken, and a proposal for a scheme costing about £4,700, to supply 9,000 people, is now under consideration of the local authorities.

Yeola.—As stated in the last year's report, this work is being carried out by the Public Works Department, and it is understood that the municipality paid the amount of the estimate into the Government account two years ago. The Executive Engineer states that not much progress has been made with the work, and that the indent for straight pipes and engines has only just gone in. The necessity for the water has been acknowledged repeatedly.

Ahmednagar.—The water-supply of this town is yearly becoming a more and more serious question. Lying, as it does, on a high tableland at about the boundaries of the N.E. and S.W. monsoons, it is liable to a recurring deficiency of rainfall. For some reason, the level of the subsoil water during the last 10 or 15 years has been steadily falling, affecting all the wells, and also the old aqueducts on which the city relies for its water. The only solution is the completion of the Kápurwádi tank, at a cost of about £10,000 for the work left undone at the end of the last famine. This tank lies over the upper portion of two of the old aqueducts, one of which will feed the city, and the other the cantonment and remount depôt. The water will percolate down into the aqueduct galleries, so that filter beds will be unnecessary. The municipality have prepared a scheme, at a cost of a little over two lakhs (about £18,500), for pumping and distributing this water under pressure throughout the town; and it is believed that the Executive Engineer similarly proposes to deal with the water of the other aqueduct for cantonments. The prevalence of enteric in the cantonments, and the recurrence of cholera in Ahmednagar, and in Bhingar, which adjoins the Sadar Bázár, points to the urgent necessity of doing away with the insanitary dipping wells and cisterns. The municipality has already spent a loan of a little over a lakh (about £7,000) on pumping and distributing water from one of the other aqueducts to about one-third of the town, and have incurred a further debt of about the same amount for plague expenses; their normal revenue is only about £4,700, and for the last two years it has been much less, so that probably the most they could do would be to carry out the pumping and distribution of the water to the rest of the town. From the increasing scarcity of subsoil water during the last two years, it is almost certain that, unless the next rains there are very favourable, there will have to be a move on the part of many of the 40,000 inhabitants of Ahmednagar, and of the 10,000 of Bhingar and the Sadar Bázár; and possibly also on the part of the troops, and of the large number of horses in the remount depôt. If Government could see their way to completing the tank, which has already been partially done as a famine work, it would solve what promises to become a very serious matter in the near future.

Kirkee.—The water-supply project for this cantonment is now nearly completed, and filtered water, under pressure, has been supplied to Government House, Ganesh Khind, and to most of the area to be served, for some months.

Poona.—Government have directed the Sanitary Engineer to get up a complete drainage scheme for this city; and one for the adjoining crowded Sadar and Sholápur Bázárs, which contain about one-fifth of the population of the adjoining city, the relative figures being about 22,400 and 127,000 respectively at present. It is hoped that this will be ready for consideration during the monsoon.

Wái.—The Executive Engineer carried out a series of levels, and drew out rough estimates for two alternative schemes, which have been practically shelved by the municipality.

Belgaum.—The military authorities have now declared themselves in favour of a combined water-supply project, which the municipality also are inclined to favour if they are relieved of their plague debt ; and it is to be hoped that Government in the Public Works Department will shortly examine the plans and estimates.

Akalkot.—This water-supply project is fast approaching completion, and it is hoped that the engines will be at work during this next hot season, *i.e.*, within less than a year of the final sanction. The work has been carried out under the superintendence of the Sanitary Board.

Sassoon Hospital, Poona.—The plans and estimates for the urgently required improvements to this building have been drawn out by the Sanitary Board in consultation with the Civil Surgeon, and have been submitted to Government.

Sholápur.—The municipality still continue the dangerous practice of relying on practically one engine for the water-supply of this important town ; and even this engine is now overworked. If it breaks down, even temporarily, the consequences will be disastrous. During the last two years the Executive Engineer has been getting up a drainage project, but he reports that the survey is not yet complete, and that he proposes to take up the elaboration of the project after July.

Sátára.—The question of Government taking over the management of the water-supply, in the interests of the inhabitants, both of the town and of cantonments, is still under discussion. The health of both communities would be benefited by such a measure, as the municipality are quite unable to supervise the miles of open channel from the Kás tank, so as to prevent pollution of the supply ; and yet the Municipal Commissioners seem to consider it derogatory to their dignity to allow the Government Executive Engineer to supervise this work for them, although his supervision would cost them nothing. If Government buys up the municipal rights, the provision of filter beds, and of a properly piped water-supply in the town, should be insisted on in place of the present insanitary dipping cisterns. From the nature of the site, a pressure of several hundred feet can probably be got in *two* places close to the town ; and with proper piping this might be utilised for electric light and power machinery, and still leave an ample head for the water-supply.

Miscellaneous.—The Board considered and advised upon the plans for the Lunatic Asylums at Nowpáda and Ratnágiri, and also advised on the preliminary proposals for the water-supply at Kundgal.

The Board again represented to Government the advisability of giving them executive, as well as consultative, powers ; so that they can both initiate and supervise the construction of important sanitary works of water-supply and drainage for municipalities, as the experience of past years proves that municipalities can only be induced to take up, and carry through, such measures by constant pressure and urging, and Executive Engineers have not the time for this work. We are more than ever convinced that it is only in this way that the construction of such urgently required works can be pushed on.

As regards the other municipalities mentioned in our last Report, we can only say that nothing whatever has been done regarding the points noticed therein.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER, 1898.

The following table gives a summary of the shipping and health of the Port of Bombay, and of the work in connection therewith, for the year ending 31st December, 1898 :—

Vessels, including Country Craft.	Number of Vessels Inspected.	Number of Persons Inspected, including Crew on Vessels.	Number of Vessels Disinfected.	Number of Persons Vaccinated.	Number of Persons segregated or rejected.	Diseases and Number of Cases of Each.								
						Plague.	Cholera.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Enteric Fever.	Suspicious Fever.	Beri Beri.
Entered	18,081	285,743	20	150	4,277	5	—	8	3	3	5	1	3	2
Left	53,392	921,828	4	—	14,911	96	—	—	—	—	—	—	—	—
In Harbour during the year ...	25	—	25	—	—	17	5	—	1	—	5	—	—	—
Total	71,498	1,207,571	49	150	19,188	118	5	8	4	3	10	1	3	2
1897	72,898	1,313,117	69	161	42,552	169	30	11	4	9	—	1	—	—

It will be seen from the above table that 71,498 vessels of all sorts, with 1,207,571 crew and passengers, were examined during the year. The number includes every person who left Bombay by sea during the year, as well as those who arrived from the ports of Western India between Karáchi and Bhatkal, inclusive, between the dates of 1st January and 20th April, 1898. After the latter date, and up to the end of the year, arrivals from infected ports only were subjected to a medical examination.

The total number of plague cases detected during the year 1898 was 118.

The following table furnishes further particulars regarding vessels which entered the port during the year 1898 :—

Year.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Indian Ports.	Number of Passengers.	Total Number of Native Sailing Craft which entered Bombay Harbour from Indian Ports.	Number of Passengers.
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1898	557	28,484	281	215	1,542	269,725	40,190	1,986
1897	551	27,605	204	191	1,583	289,154	36,831	2,217

There is no complete record kept of the crew of incoming vessels, and in the case of native sailing craft none of either crew or passengers ; hence the total number of persons who arrived by the vessels shown in the above table cannot be given. Of the 300,410 passengers shown in columns *c*, *e*, *g*, and *i*, 18,466 were troops, 1,342 pilgrims from Mecca, and the remaining 280,602 chiefly passengers from ports near Bombay.

The following table gives the number of ships which had infectious disease on board on or before entering the harbour :—

Class of Vessel.	Number of Ships.	Total Number of Crew and Passengers.	Diseases and Number of Cases of Each.								Number of Persons Vaccinated.
			Plague.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Enteric Fever.	Beri Beri.	Suspicious Fever.	
Troopships	6	9,350	—	—	2	3	1	1	—	—	—
Pilgrim ships ...	2	526	—	6	—	—	—	—	—	—	139
Other vessels...	12	2,445	5	2	1	—	4	—	2	3	11
Total	20	12,321	5	8	3	3	5	1	2	3	150
1897	73	7,033	14	3	3	6	—	1	—	—	111

Vessels which became infected while in port are not shown in the above table, but are noticed in the table on page 186.

The cases of measles, scarlatina, chicken-pox, and enteric fever shown in the foregoing table as having occurred on board the troopships were landed and isolated in the Military Cantonment at Colába. The small-pox cases were removed to the Arthur Road Hospital on shore, and such of the persons amongst the crew and passengers as were found unprotected by previous vaccination or small-pox were vaccinated. The total number of persons thus vaccinated was 150. Out of the 12 other vessels referred to in the above table, 5 entered the port with a case of fully developed plague on board of each of them. Four of the vessels were Shepherd's coasting steamers from infected ports in close proximity to Bombay.

Table showing the number of vessels, crew and passengers examined on arrival at Bombay :—

Months.	Number of Vessels Inspected.			Number of Persons Inspected.							Number of Persons Segregated.		
				Passengers.		Crew.		Total.					
	Number of steam ships and square-rigged vessels.	Number of native sailing craft inspected.	Total.	Steamships and square-rigged vessels.	Country craft.	Steamships and square-rigged vessels.	Country craft.	Number of passengers.	Number of crew.	Number of crew and passengers.	Passengers.	Crew.	Number of crew and passengers.
January	181	4,249	4,430	11,311	335	3,427	28,097	11,646	31,524	43,170	2,986	—	2,986
February	102	4,793	4,895	13,279	209	2,852	32,089	13,488	34,941	48,429	415	1	416
March	121	4,378	4,499	21,595	663	3,919	29,681	22,258	33,600	55,858	461	7	468
April	91	3,756	3,847	24,896	323	3,412	26,996	25,219	30,408	55,627	189	2	191
May	46	—	46	7,133	—	3,079	—	7,133	3,079	10,212	88	—	88
June	88	—	88	16,038	—	3,966	—	16,038	3,966	20,004	66	—	66
July	37	—	37	2,411	—	2,550	—	2,411	2,550	4,961	3	—	3
August	36	—	36	1,383	—	2,739	—	1,383	2,739	4,122	—	—	—
September	37	—	37	3,523	—	2,724	—	3,523	2,724	6,247	7	—	7
October	38	1	39	7,544	—	2,863	6	7,544	2,869	10,413	2	—	2
November	36	—	36	9,275	—	2,478	—	9,275	2,478	11,753	20	—	20
December	51	40	91	11,681	161	2,922	183	11,842	3,105	14,947	30	—	30
Total ..	864	17,217	18,081	130,069	1,691	36,931	117,052	131,760	153,983	285,743	4,267	10	4,277

The examinations from 1st January, 1898, up to 20th April, 1898, include all arrivals from ports on Western India between Karáchi and Bhatkal inclusive, as all such ports were more or less plague-infected up to that date. From 21st April until the end

of the year only vessels arriving from infected Indian Ports and Hong Kong were examined before the issue of pratique.

The following table shows the number of outward vessels and their passengers and crew inspected month by month from 1st January to 31st December, 1898.

Months.	Number of Vessels Inspected.			Number of Persons Inspected.							Registered Number of Persons Rejected.				Total number of crew and passengers rejected.
				Passengers.		Crew.		Total.			Passengers.		Crew.		
	Number of steamships and square-rigged vessels inspected.	Number of native sailing craft inspected.	Total.	Steam-ship and square-rigged vessels.	Country craft.	Steam-ship and square-rigged vessels.	Country craft.	Number of passengers.	Number of crew.	Number of passengers and crew.	Rejected.	Sent to hospital for observation.	Rejected.	Sent to hospital for observation.	
January ..	202	4,659	4,861	43,206	5,426	10,848	31,468	48,632	42,316	90,948	1,463	506	6	80	2,055
February ..	191	4,622	4,813	40,487	342	10,097	32,346	40,829	42,383	83,212	2,234	110	—	51	2,395
March ..	220	4,555	4,775	37,398	578	12,633	31,373	37,976	44,006	81,982	856	606	8	60	1,530
April ..	225	6,134	6,359	33,290	312	12,222	43,341	33,602	55,563	89,165	601	520	—	58	1,179
May.. ..	249	6,837	7,086	33,453	49	12,933	46,680	33,502	59,613	93,115	802	712	—	158	1,672
June ..	185	1,768	1,953	19,227	32	10,224	13,809	19,259	24,033	43,292	381	105	21	30	537
July.. ..	154	912	1,066	11,800	813	9,398	7,044	12,613	16,442	29,055	145	65	20	67	297
August ..	162	2,238	2,400	17,400	3,629	9,470	15,658	21,029	25,128	46,157	421	152	64	53	690
September .	192	3,259	3,451	26,998	4,620	10,731	21,447	31,618	32,178	63,796	578	213	34	60	885
October ..	243	4,442	4,685	46,579	6,169	12,938	28,033	52,748	40,971	93,719	871	218	33	98	1,210
November .	237	5,320	5,557	41,750	6,547	12,473	33,210	48,297	45,683	93,980	726	231	19	50	1,026
December..	250	6,136	6,386	51,953	7,788	13,557	40,109	59,741	53,666	113,407	990	328	7	110	1,435
Total ..	2,510	50,882	53,392	403,541	36,305	137,464	344,518	439,846	481,982	921,828	10,068	3,766	212	875	14,911

During the year under report the total number of outward-bound vessels, crew and passengers examined was 53,392, 481,982, and 439,846 respectively. Out of the 53,392 vessels shown in the foregoing table, 381 vessels left with 30,991 crew and 26,997 passengers for Aden, Red Sea, and Europe; 402 vessels, with a total of 30,742 crew and 12,693 passengers, for ports out of India other than Aden, Red Sea, and Europe, and the remaining 52,609 vessels, with 430,249 crew and 399,886 passengers, for Indian ports, including Burma. Since the 1st September, 1898, the inspection of the crew and passengers of outward-bound vessels which sailed to ports other than Indian ports has been made by day on shore prior to their embarkation, as directed by the Venice Sanitary Convention. The ship's company was again inspected on board before the issue of a Bill of Health immediately before departure from this port. The Bill of Health form B., prescribed by the Government of India in 1890, and issued to vessels sailing for foreign ports, was accordingly revised by the addition of the following words in manuscript after "passengers or crew" in the last line of the 1st clause of the Bill, *viz.*, "who have been examined by day on shore before embarkation and found free from plague."

During the year the sanitary condition of all outward-bound vessels was well looked after by the commanders and agents. The forecastle was painted or limewashed before departure. The inside of the crew's boxes was similarly dealt with, and the clothing and bedding of the crew were exposed to the sun. Bilges in native craft were generally found clean, and were carefully attended to. The holds of all vessels in ballast were thoroughly cleaned, and in most cases limewashed or disinfected with a solution of carbolic acid.

Arrangements were made with the P. & O. Company by which the bedding and clothing of the native crew on ships bound to Europe was disinfected.

The overcrowding of crew's quarters, which was brought to the notice of Government in previous reports, was not marked during the year under report. During the year 1897

the overflow pipes from the water tanks on board of some vessels were found to discharge directly into the bilges. This insanitary state of affairs, noticed during the year 1897, was observed during the past year. During the months of November and December the water tanks of all vessels were examined, and out of 163 ocean-going steamers 14 were found to have the overflow pipes from the water tanks leading into the trough in connection with the bilges.

Infectious Disease on Vessels in the Harbour.—The following table includes all steamers, square-rigged vessels and native craft which became infected while lying in the port, and is inclusive of those given in the first table on page 184, which became infected while at sea, or whose passengers developed plague after arrival :—

Months.	STEAMERS.											BUGGALOWS, TONIES, PROWS, STEAM LAUNCH, &C.										TOTAL NUMBER OF CASES OF INFECTIOUS DISEASE IN THE BOMBAY HARBOUR.									
	Number of Ships.	Cholera		Small-pox.		Chicken pox.		Measles		Plague.		Number of Native Craft.	Cholera		Small-pox.		Chicken pox.		Measles		Plague.		Total number of infected Vessels.	Cholera		Small-pox.		Chicken pox.		Measles		Plague
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
January ..	1	—	—	—	—	—	—	—	—	1	1	4	—	—	—	—	—	—	—	—	4	3	5	—	—	—	—	—	—	—	—	5	4
February .	—	—	—	—	—	—	—	—	—	—	—	9	3	3	—	—	—	—	—	—	6	5	9	3	3	—	—	—	—	—	—	6	5
March ..	2	—	—	—	—	4	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	4	—	—	—	1	—
April ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
May ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
June ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
July ..	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—
August ..	—	—	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—	—	—
September	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—
October ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
November	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
December.	2	—	—	—	—	1	—	1	—	—	—	4	1	1	—	—	—	—	—	—	3	3	6	1	1	—	—	1	—	1	—	3	3
																						Total ..	25	5	5	—	—	5	—	1	—	17	15

All the above vessels, including those in the first table on page 184, were thoroughly disinfected in accordance with the rules laid down in the Venice Sanitary Convention.

Disinfection of Ships and General Health of the Shipping.—During the year 1898 the total number of infected vessels of all sorts disinfected under the personal supervision of the Port Health Officer or his staff, assisted by the Water Police, was 49. The Resident Transport Officer arranged for carrying out the Port Health Officer's recommendations for the disinfection of transports in which cases of infectious diseases occurred.

The general health of the harbour population was fairly satisfactory during the year. The various hospitals in the city admitted, during that time, 814 persons connected with the shipping. This number of admission is exclusive of plague. Of these, the St. George Hospital admitted 485 Europeans, of whom 18 died ; the Jamsetji Jijibhoy 54 natives, of whom three died ; and the Gokuldas Tejpal 275 natives, of whom 19 died.

No deaths occurred from the effects of cleaning bilges of ships during the year, but the Coroner of Bombay held one inquest on the body of a lad who had died from suffocation while cleaning an engine-well on board the S.S. "Dean," and 13 inquests on persons who had met with their deaths from accident on board the ships in the harbour and in the docks.

Red Sea Pilgrim Traffic.—Owing to the existence of plague in Bombay, the pilgrim traffic between the Indian ports and Jeddah was stopped during the year 1898. Accordingly no vessels with Mecca pilgrims left this port for Jeddah during the year, but 1,342 pilgrims returned from Jeddah *viâ* Aden and other routes. The baggage of all returning pilgrims was disinfected by the Port Health Officer, under the orders of the Government of India. The pilgrims were not allowed into the town, but were sent direct from the ship to their homes in batches by rail, at the expense of Government.

Emigration Traffic.—During the year four ships left Bombay with emigrants for the Uganda Railway and Seychelles. The emigration traffic was closed from Bombay on

account of plague, and no vessels with emigrants sailed after the 26th February, 1898, from the port of Bombay, with the exception of the S.S. "Patna," which left the port on 9th October, 1898, with 274 emigrants for the Seychelles Government under Government of India Notification, No. 1,999—12-26, dated 23rd September, 1898.

Sanitary State of the Harbour and Foreshore.—No remarks are made on the state of the harbour and foreshore as they were not inspected during the year owing to pressure of work.

Plague.

Owing to a marked recrudescence of the plague in January an exodus set in, and 30,878 more people left Bombay by sea than arrived during that month. They were chiefly mill-hands and labourers who had their homes along the coast in close proximity to Bombay. In order to prevent the spread of plague to the coast ports Government directed that in addition to the inspection before leaving Bombay the people were to be inspected a second time at the port of arrival. Native craft were prohibited from taking native passengers, so that the inspections at the coast ports could be carried out at the places where steamers called.

It has been our experience that in almost all cases of plague a slight increase of temperature exists for a few days before the more marked signs and symptoms show themselves. It is for this reason that the most accurate means should be taken to obtain the correct temperature of suspected individuals at the examinations. Temperatures have been taken in the axilla since March with half-minute thermometers. These temperatures are not as a rule accurate. If they are taken in the early morning the skin of the natives has been cooled by exposure to the air, and if they are taken during the heat of the day the skin is also cooled by evaporation owing to perspiration. It is for these reasons that a slight rise of temperature in a native cannot under the circumstances under which they are examined by us be detected unless it is taken in the mouth. This had been the custom at one time. Every possible precaution had been taken to remove sanitary or sentimental objections. The thermometers were washed in carbolic acid lotion, and afterwards in a stream of water from a tap. Each caste had its own set of thermometers, and temperatures were taken by one of their own caste people, but the system had to be abandoned owing to caste prejudices. At our inspections during the year we came across instances where passengers suffering from a rise of temperature tried to reduce it immediately before the examination by wetting their bodies with water, sucking ice, or taking doses of phenacetine.

Owing to the diminution of plague along the coast ports near Bombay, inward sea inspections from such places were suspended on 20th April, and only vessels coming from infected ports were examined.

When the third marked epidemic of plague in Bombay commenced towards the end of the year, arrangements were made with the P. & O. Company for the disinfection of all the clothing and bedding of the native crew prior to sailing. This disinfection has now been extended to the clothing and bedding of all native crews bound to any port out of India, and is working satisfactorily.

The newspapers reported cases of plague from Bombay at foreign ports from time to time, but subsequent enquiry in almost all cases proved that they were not cases of plague. They were generally natives who had suffered from chronic enlarged glands, and who had been so unfortunate as to be suffering from an attack of malarial or other fever at the time the ship arrived in a foreign port. In order to avoid such cases being classed as plague, we insist on the passenger providing himself with a medical certificate which he can produce at a foreign port. In the case of one of the crew full particulars are entered in the official log book, so that the captain may be able to produce it as evidence to show that the disease is not due to plague. This is done with a view to save the vessel and passengers unnecessary restrictions at ports outside of India.

The P. & O. Steamship "Caledonia" was reported to have had plague at Suez in November last. The following is the history :—

At our examination on the 19th November, 1898, we found a man with fever. He was sent for observation, and the doctor in charge of the hospital reported that it was plague. The information was telegraphed to Suez by Government, and on the arrival of the vessel at that port two native crew suffering from fever were removed from the ship. Reuter telegraphed as an item of news that they

were plague cases. We wrote to Egypt for details of the cases, and at the same time asked for a list of plague cases imported from Bombay during the year 1898. The President of the Quarantine Board replied that neither of the men removed from the "Caledonia" could be considered to have developed plague, and further, that no genuine case of plague had been imported from Bombay during the year 1898.

Another case of plague was reported in the newspapers to have been imported into Ceylon from Bombay. This turned out to be a man with chronic enlarged glands. He had been a resident in Bombay, but left by rail for Tuticorin, where he embarked for Colombo. The medical officer at Colombo wrote to say that the man was not suffering from plague.

Efforts were made by certain newspapers to trace the outbreak of plague in Madagascar to Bombay. At first it was stated that it had been brought by native craft, but this theory was given up. It was then stated that it had been imported by a rice-laden steamer from Bombay. The last steamer which left Bombay for ports in Madagascar, either directly or by first calling at an intermediate port, sailed on the 9th August, 1897. She had a doctor on board. As far as we know, plague broke out in Tamatave in November or December, 1898, that is fifteen months after the last steamer left Bombay for Madagascar.

During the year 17 cases of plague were found on vessels and native craft in the harbour. Besides these, 96 cases were prevented from sailing on vessels leaving the port, and 5 were found on vessels coming from infected ports close to Bombay.

A special sanitary police force was found necessary to assist the port health staff in carrying out the provisions of the Venice Convention. Government, therefore, sanctioned 12 European and 50 native police for such work, and placed them under the orders of the Port Health Officer.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1898-99.

(W. R. Bright, Esq., Chairman.)

Review of the Period 1888–1899.

When the system of Government of the town of Calcutta was about to be changed in 1888 by the introduction of the present Act, the Commissioners, in the Annual Report for the year 1887–88, gave a short history of the principal works carried out and the principal reforms effected during their tenure of office.

Eleven years have passed, and the constitution of the Corporation is again on the eve of important changes. The present time would therefore appear to be one when the Commissioners should give an account of their stewardship. They have met with much criticism in the past, and as they believe that their critics have been in a great measure ignorant of the real extent of the important works carried out by them, it seems only just that a plain statement of facts should be given of the work actually done. The Commissioners are fully aware that there is much need for improvement, and had they unlimited funds at their disposal, they would have been able to do far more than they have done. But they maintain now, as they maintained in 1888, that they have effected a large number of improvements, that these improvements have been wisely chosen, and that they have arranged for the expenditure of as large a sum of money as they could possibly have done in view of the financial position of the Corporation.

Putting aside the constitutional changes which were introduced by the present Municipal Act, the most important feature of the past 11 years has been the inclusion of the Suburban and Added Areas in the Town Proper. In the Annual Report for 1885–86 the late Sir Henry Harrison wrote as follows :—

> Turning now to the new area to be added to the town, hardly a rupee of capital has been expended upon it, and such expenditure is quite as urgently requisite as it was 20 years ago in the case of the town.
>
> 1st.—The water-supply of the town should be extended so as to give reasonable facilities for obtaining pure water for domestic purposes to all residents in the suburbs.
>
> 2nd.—Some system of underground drainage should be introduced, and even if it is not on nearly so expensive a scale as that of the town, it must cost at the best a large sum of money.
>
> 3rd.—The new area is intersected with tanks, many of them filled with most unwholesome water, the number of which far exceeds that in the town 10 years ago. The opinion that filling up tanks with refuse is dangerous seems to be daily gaining ground, and it is very probable that before long it will be prohibited ; in that case considerable outlay for the conveyance of earth from a distance will be requisite.
>
> 4th.—The condition of the Mahomedan burial-grounds is such that it is imperatively necessary to take up land at an estimated cost of 1½ lacs (£10,000), in order to enlarge them and allow a suitable interval between the use of the same ground for a second interment. It is found that at present the same land has to be used over and over again, after three years in the less crowded, two in some of the others, and scarcely more than one year in the most crowded cemeteries. A proposal is already before Government to appoint a Mahomedan Burial Board to supervise and control the Mahomedan cemeteries, the condition of which is at present such a serious menace to the health of the localities in which they are situated, and if this proposal is adopted, it may be taken for certain that their first application must be for a liberal outlay of money, probably two lacs (£13,300), which ought to return an income sufficient to pay the interest and up-keep of the cemeteries. Will the Government give the money, or will it refer the board to the municipality ?
>
> 5th.—The conservancy of suburbs is at present managed by the contract system, and it is understood that it does not give satisfaction. It will be at least desirable to incur a considerable outlay in building Gowkhanahs and purchasing conservancy carts and cattle ; possibly also a railway extension may be necessary, so as to remove the bulk of the refuse more easily to a distance.
>
> 6th.—A proper *dhobikhana*, as at Bombay, where dhobees will be provided with pure water and other cleanly surroundings will also be a great desideratum. This should pay its own way easily, but it will require capital at the outset.
>
> It would be easy to add to the list, but the above outline is sufficient to show that a considerable outlay in the form of capital is a *sine quâ non* to the success of the new corporation, the return being partly in the form of a water-rate, partly of a direct income, partly in the enhanced value of property.

It is interesting and instructive to note how far these needs have been supplied :—

1st.—As regards the supply of filtered water to the suburbs, the history of the past 11 years is one of continuous progress. The actual scheme for the extension of the filtered water supply was completed in 1888-89, but much has since been done to increase and improve the supply of the suburbs. A new pumping station has been erected at Bhowanipur, with reservoir, engines, engine-house and quarters, &c., complete. The cost of this was :—

	£
Cost of land acquired	19,287
Cost of reservoir to hold 3 million gallons	8,874
Engines and boilers	10,350
Engine-house and boiler-house, quarters, &c.	9,446
	47,957
Then a pipe-bridge was constructed over Tolly's Nullah at a cost of	3,590
And roads were constructed within the pumping station compound at a cost of	473
Total	52,020

No less than 132·03 miles of mains and services have been constructed at a cost (including alterations to mains and piping) of Rs. 10,30,562. This makes a total expenditure of Rs. 18,10,859, and to this should be added part of the expenditure incurred in increasing the pumping power of the town. As a result of this large expenditure the added and suburban area is now supplied throughout with an excellent supply of filtered water. The first need of the added area has therefore been met.

The second crying need of this area was declared to be the provision of a scheme of underground drainage. This question and that of improving the drainage outfall of the town area was gone into most carefully by the corporation. After the opinion of experts had been taken, a joint report was drawn up by Messrs. Kimber and Hughes, and after this had been sanctioned, the work was split up into three contracts, numbered II., III. and IV. Of these III. and IV. relate almost exclusively to the added area. The estimate of the former was nearly 20 lakhs (£133,000), while the final estimate of the latter exceeds six lakhs. The latter is practically complete, while the former is under construction. It will probably take nearly three years more to complete the whole scheme in all its details, but the work has made good progress, and it is hoped that the scheme when finally carried out will be entirely successful. Due action has, therefore, been taken to provide for the needs of the suburban area in this respect.

The third point, upon which improvement was said to be required, was to fill up the filthy tanks which are so numerous in the suburbs. It has been found impossible to deal adequately with this very large question, but the provision of filtered water has done away with all necessity for using the water of these filthy tanks for drinking. A number of tanks have no doubt been filled up, but the total number is so large that very little impression has been made upon it.

The next point upon which improvement was required was stated to be the provision of proper Mahomedan burial-grounds. Here again this need has been to a certain extent met, as the corporation two years ago provided a fine cemetery at Gobra, which has been filled up much faster than was expected, and the enlargement of which has now been sanctioned. The total cost amounts to £2,372. There still remains the provision of a cemetery in Maniktolla, but it has been found to be most difficult to select a suitable site, and the matter is still under consideration. The Mahomedan Burial Board, which is in charge of cemeteries, has no income of its own except a grant from Government sufficient to meet the office expenditure, and the only body which is called upon to pay the expenses of providing these burial-grounds is the corporation, which, in the face of the large contracts entered into for the extension of unfiltered water-supply and the improvement of the sewage system, has very little money to spare.

The next point upon which improvement was declared to be necessary was in the conservancy of the suburbs which was managed by the contract system. Here again much has been done to improve matters. An incinerator has been erected at Goragatcha, at a cost of £3,934, which deals successfully with the conservancy of

wards 23, 24 and 25. The contract system is now in force only in wards 23, 24 and 25 for removal of refuse, but for sullage and trade refuse it is in force in wards 19 to 25. But it is in the matter of the disposal of night-soil that great improvements have been effected, and the trenching system has been entirely abandoned owing to the construction of temporary sewage depôts at Hazra Road and Budge-Budge, where the night-soil is emptied into the sewers and then pumped into the large Circular Road Sewer at Bhowanipur. This scheme necessitated an expenditure of £26,222.

The last improvement suggested by Sir Henry Harrison was the establishment of a *dhobikhana*. Here again, the need has been met. A municipal *dhobikhana* was erected at a cost of £3,398, including the cost of acquisition of land. The yearly income and expenditure have been as follows :—

Year.	Income.	Expenditure.	
	£	£	
1896-97	26	3	Only for a portion of the year.
1897-98	171	46	
1898-99	169	46	

so that it is yielding a net return of 3·2 per cent. on the capital expended on its construction.

The foregoing paragraphs will have shown that, since the added area has been included, the corporation has either fully or partially met all the needs of the added area which were declared to be most pressing. They have given a full supply of filtered water, they are constructing a complete system of sewers, they have established an incinerator to dispose of the refuse, and have changed the system of the disposal of night-soil, while they have instituted a municipal *dhobikhana*.

But they have done much more than this, for they have extended the unfiltered water-supply to the south added area, and have opened out a number of very fine roads. On the former they have expended £53,237 (including 41·75 miles of mains, branches, and hydrants). On the latter they have expended—

	£
Badiapara Road	22,543
Landsdowne Road	21,814
Kalighat Bridge to Russa Road	8,232
Judge's Court Road	847
Chetla New Road	5,374
	58,810

It would be wearisome to go into the improvements effected in the suburbs at any greater length. Under the Act the corporation is bound to spend a sum of not less than £20,000 a year on the improvement of the suburbs. After taking into consideration certain capital expenditure the interest upon which according to the opinion of the Advocate-General is justly debitable to this fund, the amount of interest now payable for works benefiting the suburbs at present exceeds £20,000, which was the minimum to be spent yearly from revenue upon the suburbs.

Leaving the financial side of the question, it is most important to see whether the works carried out for the improvement of the suburbs have had a beneficial effect upon the health and well-being of the people of those parts. Taking the two diseases fever and cholera as those which we might expect to be affected by the extension of the filtered water-supply, the results are most satisfactory. In the two quinquennial periods before the amalgamation the five yearly averages of deaths in the suburbs from fever alone amounted to 4,657 in the first, and 3,754 in the second period. Since the amalgamation the five yearly averages have been 2,959 and 3,424 respectively. The increase in the second period is coincident with an even greater increase in the town. Part of it is no doubt due to increase in population, as the figures are calculated upon the census figures of 1891.

As regards cholera, however, the improvement is much more marked. Taking the six years previous to the amalgamation there were only two years in which the total number of deaths from this cause was less than 2,000 per year, and the lowest number of deaths recorded from this disease was 1,641 in 1885-86. The average annual number of deaths

from this cause during this period was 2,101. From the date of the amalgamation onwards there have been only three years in which the total number of deaths exceeded 1,000, while the quinquennial averages have been 918 for the first and 692 for the second period. No words are needed to show how great an improvement has been effected in this case by the works carried out since the amalgamation. Even now, however, the rates per mille are higher in the suburbs than in the town, and this is probably attributable to the vastly larger number of tanks still in existence there.

As regards fever, the decrease observable is the more satisfactory as it might well have been expected that the provision of an ample filtered water-supply without the necessary *pukka* drainage system to carry off the sullage and waste water might have resulted in great water-logging of the soil and a consequent increase in malaria. With the completion of the new drainage system for the suburbs it may be confidently expected that the death-rate from fever will diminish, while the construction of a drainage system in the fringe area will, it is hoped, have the same effect for that part of the town.

Turning now to the administration of the town as a whole, the history of the last 10 years is a record of large sums yearly spent on improvements.

The loans raised during that period have amounted to over £1,000,000.

An additional loan of 4 lakhs (about £27,000) was also raised for plague expenditure, the date of the debentures being the 1st May current; but as this loan was for an exceptional cause, it has not been included in the above amount, which is of sums raised for the improvement of the town and suburbs.

The total expenditure on improvements from 1889–90 up to the beginning of the past year has been:—

	£
From Capital	1,004,744
From Revenue	110,679
Or a total of	1,115,423

What then has been the net result of the expenditure under the main heads? As regards drainage a large amount has been expended on the unfinished projects for the suburban area, as well as for the town outfall. As regards the town proper, in 1888–89 there were 37·3 miles of brick and 140·3 miles of pipe sewers. There are now 42·71 miles of the former and 150·24 of the latter. At the same time there has been great improvement in the number of times the sewers are cleaned and flushed. In 1888–89, 386·28 miles of brick and 3,514·27 miles of pipe sewers were flushed and cleaned, while in 1898–99, 852·20 miles of brick and 9,066·09 miles of pipe sewers were similarly treated. That is to say, that while in 1888–89 each brick sewer was cleaned on an average 10 times and each pipe sewer 25 times, in 1898–99 each brick sewer was cleaned on an average 20, and each pipe sewer 60 times. Much importance is rightly attached to the periodical cleansing of the sewers, and the increase noted above is a real improvement.

Provision is being made this year to lay unfiltered water pipes to the summits of the sewers which we have hitherto been unable to flush owing to their position, and arrangements are also being made for maintaining the pressure of the unfiltered supply throughout the hours of the day and practically the whole of the night. It will then be possible to greatly improve our flushing. Already automatic flushing-chambers have been fixed in several places, and these are being yearly increased in number.

The next class of work to be noted upon is roads. In 1888–89 the total length of roads in the town was 184·3 miles, including 34·9 paths over sewered ditches. The total length in 1898–99 is 201·1 miles, of which 35 miles are paths over sewered ditches. There has therefore been an increase of 27 miles of roads in the town, and while the expenditure or upkeep in 1888–89 amounted to £11,469, the amount sanctioned for the year under review was £16,000.

In dealing with the expenditure on the suburbs I have noted the new roads which have been constructed there. In the town proper the cost of land is so great that it is impossible to fix the money for making large roads. One very fine road has been made—the Harrison Road, but the actual expense of this after giving credit for sale of surplus land and taking credit for the increased assessment on the new frontages has never been ascertained. The information would be of great value, but the calculations would be extremely difficult and complicated, and the assessor, who is the only officer who could make them, is far too hard worked to be able to spare the necessary time.

The next head under which very large sums have been expended has been on the improvement of the water-supply of the town and suburbs. These briefly speaking comprise:—

(*a.*) The increase in the supply of filtered water.—In 1889–90 the average daily supply rose to 16,000,000 gallons. It is now 20,684,106.

(*b.*) The extension of the filtered water supply to the suburbs.—This has already been fully noted upon.

(*c.*) The increase in the supply of unfiltered water in the town.—In 1888–89 the daily average was 2,881,842. In 1898–99 it was 4,778,899.

(*d.*) The extension of the supply of unfiltered water to the south suburban area.—The works have been completed, and the pipes are being tested.

The result is that while in 1888–89 there were 241 streets provided with unfiltered and 601 with filtered water, in 1898–99 there were 393 streets connected with unfiltered and 1,039 supplied with filtered water.

The great task now before the corporation is to devise means for—(*a*) maintaining a continuous supply of water, and (*b*) checking the waste which undoubtedly exists, and it is in this direction that our efforts will have to be directed in the future. Both problems are difficult, but there can be no doubt that they are capable of solution, and that their solution would result in economy.

The next major head which requires special mention is that of Bustee and Town Improvement. Under the law the Commissioners are bound to spend on the completion and extension of the Calcutta Drainage Works and the opening out and improvement of bustees a sum of not less than two lakhs (£13,300) a year, to be raised by loan, and it is of course obvious that, as the sums which are spent on drainage increase, those available for the improvement of bustees must naturally decrease. Already about 33 lakhs of rupees (£110,000) have been expended on the improvement of the drainage. But in addition to this the corporation has spent more than 5 lakhs of rupees (£33,000) in opening out bustees during the period under review. Projects which will involve another 5 lakhs of rupees have been sanctioned, and are only kept in abeyance owing to the very large sums which are being expended on drainage works, and many other projects are under consideration. The Commissioners are fully alive to the necessity for improving the bustees of the town and suburbs, but they have been compelled of late years to decrease their expenditure in this line in view of the heavy liabilities which they have incurred in their large contracts for the improvement of the drainage and sewerage system.

So much attention has been drawn of recent years to the conservancy of the town that it seems necessary to devote a short paragraph to this subject. The first point to which attention is naturally drawn is the question of expenditure. In 1889–90, the first year of the amalgamation, the expenditure was £37,926 in round numbers. In 1898–99 it had risen to £43,372. The true test, however, of the efficiency of the conservancy establishment is the amount of refuse deposited at the Salt-water Lakes.

The following figures will show how greatly the amount thus deposited has increased: —

	Waggon-loads of Town Refuse.		Waggon-loads of Town Refuse.
1889–90	21,018	1894–95	26,599
1890-91	21,899	1895–96	28,043
1891–92	23,048	1896–97	30,347
1892–93	23,956	1897–98	31,725
1893–94	25,829	1898–99	30,508

Some small part of this increase is due to the fact that the refuse of certain wards which used to be disposed of at the municipal dumping-ground is now sent to the square-mile, but this only represents a comparatively small fraction of the increase. The increase in population would, of course, naturally cause an increase, but even this would not account for an advance of over 40 per cent. this year and over 50 per cent. last year over the figures of 1889–90. As each waggon is said to contain 10 tons, the amount of refuse now removed has reached the very large figure of about 300,000 tons a year.

It is perhaps unnecessary to go at greater length into the history of the improvements effected during the past 10 years. To enter into them in greater detail would be to expand this chapter to an inordinate length. Enough has, however, been given to prove

that the history of the past 10 years has been one of continuous improvement. It is important, however, to notice at some length the financial side of the question. The Budget estimate of 1889–90 provided for an income of—

£		
180,775	...	from the General Fund
21,467	...	do. Sewage-rate.
63,134	...	do. Water-rate.
21,334	...	do. Lighting-rate Fund.
286,710		

The Budget estimate for the present year provides for an income of—

£	
213,527	... General Fund.
27,316	... Sewage-rate.
91,762	... Water-rate.
32,369	... Lighting Fund.
364,974	

The rate of taxation in both years is the same. The increase in the estimated income is due entirely to the increase in the valuation of the city. In 1889–90 the 1 per cent. rate was estimated at £11,598. In 1899–1900 it is estimated at £14,000.

At first sight it might appear that the large increase which has taken place may fairly warrant largely increased expenditure on the current needs of the town, but this is not so. In 1889–90 the estimate for interest on loans was £59,496 and that for sinking fund £23,111, or a total of £82,607. In the current year's Budget the estimated expenditure is £137,576, an increase of £54,967 in round numbers, against an increase in estimated revenue of about £78,267. It is therefore clear that while the increase in interest and sinking fund charges is still met by the increase in revenue due to the rise in valuation, there is no margin for greatly increased expenditure.

Suburban statutory 3 lakhs Accounts.—It will appear from the following statement that the corporation, while under an obligation to expend £200,000 on the suburbs during the last 10 years at £20,000 a year, have actually spent £12,560 more than this amount :—

		£	
Interest and contribution on water-supply capital expenditure up to 1898-99		14,762	
Interest on drainage and miscellaneous capital expenditure during 1898–99		6,985	
Improvements from revenue account	2,002		
Less amount excess shown in 1895–96 and 1896–97	64		
		1,938	
Cost of new lamps		61	
			23,746
Add expenditure up to 1897–98			188,814
Total expenditure up to 1898–99			212,560

Plague in Calcutta.—The year under review has been rendered memorable by the advent of plague. Although this disease had obtained a firm footing in the Western Presidency during the previous two years, Calcutta had been hitherto immune from its attack. Unfortunately this immunity did not continue during the past year, though happily in neither of the two outbreaks did the plague assume the excessively virulent epidemic character which characterised it in Bombay.

During both the outbreaks the plague operations were under the management of the Chairman. Up to the 23rd July the Health Officer was in direct charge, but on that date he made over charge to Major W. Bannerman, I.M.S. This officer was relieved by Dr. Pettifer, who remained in charge for a short time and then made over charge to Major Green, I.M.S., who remained in charge for the remainder of the year.

The first information of the approach of plague was given by the death of a number of rats on the 15th April, 1898. This was quickly followed by the report of a plague case on the 17th April. Other cases speedily followed, and on the 30th April an official announcement that plague existed in the town was made in the Bengal Council. The disease continued until the end of the rains, though most fortunately it never developed into a severe outbreak. On the 10th October the town was declared free from plague.

As was only to be expected, the declaration of plague as existent in the town led to a considerable amount of panic. Exaggerated ideas of the measures which would be taken were rife, and a very extensive exodus resulted. The measures taken to deal with this epidemic were :—

(*a.*) The establishment of public hospitals. Three were provided in addition to the old one at Manicktolla, which had been constructed in 1896, and had never been used. The new hospitals were established in—

(1.) Manicktolla, where a fine two-storied house was rented, and thatched huts constructed in the compound.

(2.) Marcus Square, where a number of sheds roofed with corrugated iron were set up.

(3.) Budge-Budge Road, where a fine house was rented and furnished as a hospital, thatched huts having been constructed in the compound.

(*b.*) Provision of ward hospitals.

(*c.*) Provision of caste hospitals.

These two classes of hospitals were equipped and arranged for by private munificence or voluntary subscription.

The liberality with which donations (in many cases large ones) were given by the citizens was most remarkable.

(*d.*) Licensing of family hospitals.

(*e.*) Segregation of sick and their careful nursing and treatment in public hospital.

(*f.*) Segregation of "contacts." House-to-house enquiries to discover cases of plague and suspicious cases.

(*g.*) Disinfection of houses, clothing, &c.

(*h.*) Inoculation.

(*i.*) Establishment of vigilance committee in each ward.

For administrative purposes the town was split up into districts, each under the charge of medical officers, most of whom had been sent out by the Secretary of State.

At first considerable opposition was met with, ambulance parties were attacked, and in one case so serious an attack was made upon a medical officer that he had to use his revolver in self-defence.

With a view to obtaining early information of cases of plague, vigilance committees were established by the commissioners in each ward. These consisted of two elected and one nominated commissioners, assisted by the leading ones. Their duties were to carefully inspect the ward, and to report as regards unusual dirt, faulty drains or sanitation, and cases of suspicious sickness or deaths, and to make suggestions for other sanitary improvements. Military officers were appointed to assist them. These committees mostly worked well, but had many difficulties to contend with.

Fortunately this attack never assumed the proportions of a severe epidemic, and when it died away in October, and Calcutta was declared to be free, there was some ground for hoping that the disease would not recur. Unhappily this proved not to be the case. Occasional cases were reported during the cold weather, and in consequence of their increasing numbers the plague rules were reimposed by Government Order No. 1,145-Medical, dated the 24th February, 1899.

There was, however, a most notable change of policy. For the first time it was resolved that, while every effort should be made to induce plague patients to resort either to the public or the ward and caste hospitals, no one should be removed against his will, and that those who were unwilling to go to hospital should be treated at their own houses, arrangements being made as far as possible to adapt the house for the purposes of a private isolation hospital. The conciliatory character of this measure greatly reassured the mind of the public, and although plague assumed an epidemic form of far greater intensity than in the previous year, the exodus of people was unimportant, and there was hardly any dislocation of trade.

On the other hand, so far as can be seen, the measures thus adopted have had no untoward effects, and the disease fell away to a vanishing point with the advent of the rains.

After the reimposition of the rules the number of plague deaths reported increased rapidly. The disease reached its maximum in April, and then gradually decreased, but between the 25th February and 1st July no fewer than 1,200 deaths had been reported from this cause alone, and there can be no doubt whatever that in spite of the conciliatory character of the measures adopted a large number of cases were concealed.

The change in the policy pursued resulted in a great change in the attitude of the people. While great opposition had been experienced during the first outbreak, practically nothing of the kind was encountered during the second and far more serious epidemic, and this change in the attitude of the people rendered work during the second outbreak much easier.

During this period the town was divided at first into four and afterwards into five districts, each in charge of a medical officer, and each equipped with a sufficient staff of medical inspectors and disinfecting gangs.

Much attention was paid to promptness in disinfection, and, as actual experience increased, it was found possible to secure extremely prompt measures in each case of reported plague.

It is unneccessary in a short *résumé* of this kind to go at greater length into the details of the administration. It is a matter for great congratulation that the milder and more conciliatory policy adopted in the second epidemic seems to have been quite as successful as the earlier and more drastic methods, while the almost entire absence of any recurrence of the disease in rooms which had once been disinfected is a striking testimony to the value of this measure.

Undoubtedly many cases were concealed, but it cannot be disputed that far more cases would have been kept back if more drastic methods had been adopted.

Moreover, it was a matter of the greatest importance that the general trade and business of the town should not be upset, as would inevitably have been the case if more drastic measures had been used. It may be safely stated that the result of the more conciliatory policy has been most satisfactory. While it has in no way tended to increase the epidemic, it has allayed panic and has enabled the ordinary business of the town to go on with little hindrance.

The advent of these two epidemics has, of course, thrown a great additional burden both upon the Commissioners and upon the Chairman. Upon the Commissioners, because it was by their efforts that vigilance committees were organised and maintained and ward hospitals started ; upon the Chairman, because, in addition to the heavy burden of responsibility which the ordinary work of the corporation entails, he had to undertake the supervision and management of the staff and methods necessary to deal with a severe epidemic. Upon the corporation too the burden has fallen heavily, as they have had to provide the funds for all the necessary arrangements and establishment. For this purpose they contracted a loan of 4 lakhs (£26,700), and further sums would have been required had not the Government come to their aid with the munificent grant of 3½ lakhs (£23,300).

It is a matter for great thankfulness that, in spite of the visitation of plague during the year, no serious interruption has been caused for any length of time in the great general municipal administration of the town. The collection of rates has been nearly up to the usual standard, while the collection of arrears has considerably exceeded the figures of previous years. In one department, however, serious difficulties were met with during the year. This was the Conservancy Derartment, and here great difficulties were caused by the strike and flight of a number of the carters.

Water Works.—The extension of filtered water mains and services during the year under report amount to ·56 mile, namely, ·29 mile in the added area, and ·27 mile in town area. Besides the above, 5 standposts have been fixed. The total mileage of filtered pipes on the 31st March, 1899, amounted to 315·05 miles. The number of premises connected during the year aggregated 568, raising the total number to 28,343. 1,992 standposts, 8 drinking fountains, 224 ground hydrants, 13 urinals, 84 bathing platforms, and 93 cattle drinking troughs are connected with the filtered system. The average daily consumption of filtered water for the year was 20,684,393, against 20,638,212 gallons in 1897–98.

The daily unfiltered supply was 4,778,899 gallons, and the consumption per head of the population (436,393) a day amounted to 10·95 gallons. The total length of unfiltered water mains and services in town area on the 31st March, 1899, amounted to 104·26 miles.

Drainage and General Construction.—During the year 2·66 miles of pipe sewers were reconstructed to new specification and 3·98 miles of brick sewers were repaired. Thirty sewer man-holes, 24 sewer lamp-holes, 49 gully-pits and 59 flushing chambers fitted with automatic flushing syphons were constructed. The public sewers, excluding 9·46 miles of bustee sewers, now measure 200·630 miles. These figures refer only to the sewers now in operation and do not include the work completed under the big contracts. Of works of public convenience, 3 double-seated urinals with white-glazed tiles have been constructed and brought into use. Four bathing platforms, four night-soil depôts, five latrines and six urinals have been thoroughly repaired. Two hackney-carriage stands paved with Indian patent stone have been constructed. 308,110 tons of refuse were conveyed by the municipal railway to the square-mile during the year. In addition to this, 16,865 tons of road metal and building material were hauled from the store depôt at Baug Bazar and unloaded at the various sub-depôts in Circular Road.

House Drainage.—Three hundred and twenty premises were connected with the public sewers during the year, bringing the total up to 30,168. The drains of 5,879 premises were examined for structural defects, and in 2,065 instances, or 35 per cent., these were discovered and notices specifying these defects were issued. The drains of 9,878 premises were re-inspected, 20,399 were specially inspected on account of the outbreak of the plague, and in 6,882 instances drains more or less obstructed were cleaned out, flushed, and disinfected. Sanction was accorded to the connection of 410 privies with the public sewers.

Roads.—The total length of roads on 31st March, 1899, was 331 miles, 6 furlongs, and 296 feet, of which 104 miles, 3 furlongs, 447 feet are stone-metalled, and 165 miles, 4 furlongs, and 620 feet are brick-metalled.

Health of the Town.—It is satisfactory to note that the year under review has been a healthy one, the death-rate being the lowest since 1893. The mortality from fevers and cholera was lower than it has ever been since 1899, while the number of deaths from small-pox was 85, against 161 in the previous year, and 577, the average of the preceding 5 years. The mortality, however, from dysentery and diarrhœa was higher in 1898 than the average of the previous 9 years. The birth-rate fell considerably below that of the previous year owing to a considerable portion of the female population having left Calcutta during the plague scare. During the year under review 192 deaths were attributed to plague—181 in the town and 11 in the suburbs.

The Health Officer calls attention to the high mortality among infants in Calcutta. In the Mahomedan community the rate of infant mortality was 634·5 out of every thousand births. That rate is nearly three times the rate among the Christian population. The registration of deaths is so unreliable that no explanation of this great difference can be obtained from that source. "The infantile mortality of Calcutta must remain high," writes the Health Officer, "until the town is opened out and a higher standard of personal hygiene, including midwifery practice, is attained."

Owing to the opposition shown to preventive inoculation against plague it was deemed advisable to suspend vaccination work for nearly three months, as the people mistook the vaccinators for plague inoculation officers, and went the length of mobbing and assaulting them. The number of cases of vaccination therefore during the year was only 13,255, against 21,620 in 1897. The fact that the majority of those who left town during the plague scare were women and children partly accounts for the decrease in the number of vaccination cases. The Health Officer again calls attention to the necessity of reducing the statutory period for compulsory vaccination.

Samples of filtered water supplied to the city were analysed, as well as samples of water drawn from the settling tanks at Pultah. The results were satisfactory, the filter-beds were found to be working well, and the drinking water to retain its general purity. Samples of water from foul tanks and wells, as well as of milk, *ghee*, and other articles of food, were also analysed. The illuminating gas supplied to the city was periodically examined.

The price of rice and *dhal* was below the average of the preceding 5 years. Common rice, the staple food of the poor, sold at 5*s.* 10*d.* per maund, against 6*s.* 10*d.* in 1897–98.

Conservancy.—30,508 waggon loads of refuse, etc., were removed from the town and a part of the suburbs, and sent to the square-mile. This figure exceeds those of any of the previous 5 years except 1897–98. 81,802 cart-loads of refuse, etc., from the rest of the suburbs were likewise collected and disposed of. A scheme for the supervision of conservancy work by dividing the wards into blocks and an afternoon service was sanctioned by the Commissioners and put into operation. The cost of the new arrangements was less than the combined cost of the old conservancy establishment and the extra gangs employed in the previous year. Owing to the unsatisfactory character of the service-privy system it has been proposed to gradually abolish it by having house privies for respectable people connected with the sewers, and getting the owners of bustees to construct proper public latrines for the use of their tenants. The Health Officer forcibly points out the highly insanitary condition of the cow-houses in the city and the enormous profits made by cow-keepers by watering milk. The following statement shows the number of tanks filled up and improved during the year :—

Tanks filled up.	Tanks improved.	Other tanks under operation.	Total.	No. of prosecutions for not filling up tanks.	Fines.
41	4	74	119	32	£ 36

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ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1898.

(*Dr. J. Nield Cook.*)

Except for the advent of plague the year was an exceptionally healthy one, and in spite of the occurrence of a comparatively mild outbreak of plague, which accounted for 192 deaths, the death-rate for the year was appreciably below the average. This was partly due to the comparatively low mortality from cholera and small-pox, but the statistical results of the year were complicated by a considerable exodus that occurred in consequence of the plague scare, and the absence of reliable data to show how many went and how long they stopped away. The outbreak of plague, from the appearance of the first case discovered in April to the time I handed over charge on the 22nd of July, is dealt with in a separate report. Since that date I have had nothing to do with the plague except as a member of the medical board, which issues the weekly statistics of the health of the town and port, and am consequently unable to report on it.

Meteorological Conditions.—The variations from the normal in barometric pressure were inconsiderable, and do not appear to have exercised any appreciable influence on the health of the town. The temperature during the first quarter was slightly below the average, 0·6°, during the second very slightest below normal, the difference being only 0·1°, during the third 0·8° below, and during the fourth 2·3° below. So, on the whole, it may be said to have been a fairly cool year. The humidity was practically normal in January and February, but 7 below in March. In the second quarter it was 1 above normal, in the third 3·6 above, and in the fourth 4·6 above. 69·88 inches of rain fell during the year, against an average of 66·39, the bulk of it falling between the last week of June and the third week in July. There was a coincident decline in bubonic plague, from over 20 to under 5 cases in the week.

Price of Food.—The price of mutton was above the average, that of beef and ghee about the same, and that of rice and dhal below it. Common rice, which is the best index of the food of the poor, sold at 5*s.* 10*d.* a maund, against 6*s.* 10*d.* in the preceding year.

Vital Statistics: Births.—The total number of births registered was only 9,530, giving a birth-rate of 13·9 per 1,000, against 12,584 and 18·4 in the preceding year. The rates are calculated on the census population of 1891. The low birth-rates in Calcutta generally are due to the population being to a considerable extent a floating one and the number of women being comparatively small. Amongst the Hindus there are 174 males to 100 females, and amongst the Mahomedans, 197 to 100. The exceptionally low birth-rate in 1898 was due to the plague exodus, which affected the female population more than the male. The male to female births were in the proportion of 114 to 100.

The Christian population was the most prolific, with a birth-rate of 18·8, the Hindus coming next with 12·44, and the Mahomedans last with 11·2.

General Mortality.—The total number of deaths was 23,343, against 24,665 in the preceding year. The death-rate, 29·8, was the lowest since 1893. The comparatively low death-rate was partly due to the year being a healthy one, no considerable outbreak of epidemic disease occurring, the mortality from cholera, small-pox, and fevers being well below the average, and partly to a reduction in the population during a portion of the year, due to the plague scare. According to locality, the death-rate varied from 12·7 in Park Street, which is hardly a fair example, as it is largely inhabited by Europeans, who send their children home and retire themselves if their health breaks down, and 36·8 in Sukea's Street. The mortality in the canal area (34·5) and suburbs (35·5) was higher than in the town, though lower than in the preceding year.

Mortality according to Age.—The mortality was lower than in the preceding year under all the age periods, most noticeably between the ages of 20 and 40. The infantile mortality appears to have been higher in the town than in the suburbs, which is in all probability due to closer aggregation, whilst the mortality amongst adults was higher in the suburbs

where the water-logged state of the ground predisposes to fevers and bowel complaints. The low mortality under 5 years was no doubt partly due to the number of children and pregnant women who left the town.

Comparative statement of death-rates according to age groups.

Year.	Under 1 year.	1—4 years.	5—9 years.	10—19 years.	20—39 years.	40—59 years.	60 years and upwards.	Total.
1897	458·5	58·3	21·8	17·7	26·2	26·6	69·3	36·1
1898	368·5	46·6	16·9	14·9	18·6	23·1	68·0	29·8

It has already been shown that the infantile mortality was below the average owing to the exodus. Still the bill was a very heavy one, and amongst the Mahomedans living in the town reached the enormous number of 634·5 to every 1,000 births, whilst among the Christians it was only 217·7. The Christians in the town are as a class poor and not specially noted for cleanliness, and they live under the same conditions of soil and climate as the Mahomedans, so it is difficult to understand why the mortality amongst the one class should be nearly three times that in the other. The causes of death registered are so unreliable as to give no clue to the explanation. The infantile mortality of Calcutta must remain high until the town is opened out and a higher standard of personal hygiene, including midwifery practice, is attained. It is further conduced to by the women in many cases working on a poor diet up to the time of confinement.

Though the actual number of deaths was much greater among males the ratio per 1,000 of the population was very much higher among females, being 37·5 in the latter to 25·7 in the former. The female mortality rate is higher at all ages, but most noticeably between the ages of 10 and 20, the age of marriage in the East, being 19·9 amongst females and 12·1 amongst males.

If "other classes" (58·0), of which the numbers are small, be excluded, it appears that the Mahomedans had the highest mortality (30·3), the Hindus intermediate (28·8), and the Christians the lowest (27·1).

The following table shows that the mortality was below the average of the previous 5 years in every ward of the town and suburbs except Ward 12, Fenwick Bazar, where it was 0·2 above. In the added area the difference was considerable. Cholera was over 2 per 1,000 in only one ward, added area, Ward 1, Shampukur. Plague was worst in Ward 12, Fenwick Bazar, smallpox in the added area, Shampukur. Fevers were worst in Ward 5, Jorabagan, in the town, and accounted for a heavy mortality throughout the added area and suburbs, especially the former. Bowel complaints were worst in Wards 1 to 3 in the town, and were especially prevalent throughout the whole of the added area and suburbs, except Alipur. It will thus be seen that though the mortality from all causes was lower than usual in the added area, that locality is still noticeable for its high mortality from preventable disease.

Statement of Deaths from different causes during 1898.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1891.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Plague.	Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Plague.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes.	From all Causes. For the Year.	Mean of previous 5 years.
1	Shampooker	29,951	31	12	174	136	3	2	4	8	—	14	427	797	1·0	·36	·1	5·8	4·5	·46	14·3	26·6	34·1
2	Coomartolly	26,614	37	1	209	129	1	1	1	17	—	19	326	722	1·4	·03	·03	7·8	4·8	·71	12·2	27·1	33·6
	Burtollah	23,374	46	13	234	127	—	5	7	19	—	31	480	931	1·8	·46	—	8·2	4·4	1·0	16·9	32·8	37·0
4	Sukea's Street..	25,750	16	—	188	87	2	3	5	4	—	12	368	673	·62	—	·03	7·3	3·3	·46	14·3	26·1	31·9
5	Jorabagan	39,180	53	27	436	146	19	1	2	20	—	23	416	1,120	1·3	·68	·48	11·1	3·7	·58	10·6	28·5	34·7
	Mayo Hospital	—	3	—	—	2	1	—	—	4	—	4	4	14	—	—	—	—	—	—	—	—	—
	Jorasanko	41,657	43	7	374	171	10	1	3	17	—	21	667	1,293	1·0	·16	·21	8·9	4·1	·50	16·0	31·0	37·6
	Burra Bazar	20,646	21	—	258	68	20	2	2	10	—	14	257	638	1·0	—	·77	12·5	3·2	·67	12·6	30·9	33·2

Statement of Deaths from different causes during 1898—continued.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1891.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Plague.	9. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Plague.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes.	From all Causes. For the Year.	Mean of previous 5 Years.
8	Colootollah	50,781	43	4	488	163	43	2	3	24	—	29	747	1,517	·84	·07	·76	9·6	3·2	·57	14·8	29·8	31·6
	Medical College Hospital ..	—	4	—	6	14	4	—	1	12	—	13	99	140	—	—	—	—	—	—	—	—	—
9	Moocheepara	39,109	33	5	328	133	6	3	5	12	—	20	688	1,213	·84	·12	·15	8·4	3·4	·51	17·6	31·0	35·8
	Police Hospital	—	—	—	4	—	—	—	—	3	—	3	1	8	—	—	—	—	—	—	—	—	—
10	Bow Bazar	22,668	20	1	207	75	22	1	1	12	—	14	362	701	·88	·04	·66	9·1	3·3	·61	16·3	30·9	31·1
11	Puddopooker	20,761	19	2	148	62	1	1	3	5	—	9	306	547	·91	·09	·04	7·1	2·9	·43	14·7	26·3	33·7
12	Waterloo Street	6,083	7	—	26	5	7	—	—	—	—	—	38	83	1·1	—	1·1	4·2	·82	—	6·2	13·6	16·4
13	Fenwick Bazar	28,366	20	1	251	98	33	1	3	2	—	6	262	671	·7	·03	·77	8·8	3·4	·21	9·6	23·6	23·4
14	Taltollah	29,207	13	—	275	93	7	1	—	6	—	7	453	853	·44	—	·24	9·4	3·2	·24	15·6	29·2	30·7
15	Collinga..	13,218	3	—	105	38	1	—	—	—	—	—	161	308	·22	—	·07	7·9	2·9	—	12·1	23·3	31·3
16	Park Street..	4,620	2	1	19	2	1	—	—	—	—	—	34	59	.43	·21	·21	4·1	·43	—	7·3	12·7	15·2
17	Bamun Bustee	4,590	—	—	25	13	—	—	—	—	—	—	54	92	—	—	—	5·4	2·8	—	11·8	20·0	56·4
18	Hastings	4,820	5	—	52	13	—	—	—	—	—	—	67	137	1·0	—	—	10·8	2·7	—	13·9	28·4	41·6
	Military Hospital	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	436,403	419	74	3,807	1,575	181	24	40	175	—	239	6,222	12,517	·96	·16	·35	8·7	3·6	·54	14·3	28·6	33·1
	Fort William	3,468	1	—	23	5	—	—	—	2	—	2	13	44	·29	—	—	6·6	1·4	·59	3·7	12·8	8·5
	Port of Calcutta	26,589	37	—	31	6	—	—	—	49	—	49	22	145	1·4	—	—	1·1	·22	1·8	8·3	5·4	7·3
	Grand Total ..	466,460	457	74	3,861	1,586	181	24	40	226	—	290	6,257	12,706	·98	·16	·32	8·2	3·4	·62	13·5	27·2	31·4
	SUBURBS.																						
1	Added Area, Shampooker..	6,934	19	6	66	30	—	—	1	3	—	3	93	217	2·7	·86	—	9·5	4·3	·43	13·4	31·2	40·6
3	Do. Burtollah ..	8,057	6	1	97	44	—	—	—	—	1	1	140	289	·74	·12	—	12·0	5·4	·12	17·3	35·8	42·5
4	Do. Sukea's Street	9,078	6	1	113	44	1	—	—	—	—	—	105	330	·66	·11	·11	12·4	4·8	—	18·1	36·3	45·9
9	Do. Moocheepara	10,363	4	—	121	48	—	—	—	16	—	16	164	353	·38	—	—	11·6	4·6	·15	15·8	34·0	24·5
19	Entally	33,147	28	—	443	182	4	1	1	18	—	20	532	1,209	·84	—	·12	13·3	5·4	·60	16·0	36·4	40·5
	Campbell Hospital	—	17	2	78	513	2	—	—	7	—	7	436	1,055	—	—	—	—	—	—	—	—	—
20	Baniapooker	23,020	7	—	273	97	2	—	—	8	—	8	297	684	·30	—	·08	11·8	4·2	·34	12·9	29·7	35·1
21	Ballygunge and Tallygunge	22,831	10	—	200	97	—	—	1	10	—	11	379	697	·43	—	—	8·7	4·2	·48	16·6	30·5	42·4
22	Bhowanipur	42,591	44	—	339	188	—	2	3	17	—	22	558	1,151	1·0	—	—	7·9	4·3	·51	13·1	27·0	35·5
	General Hospital	—	3	—	3	3	—	—	—	3	—	3	15	27	—	—	—	—	—	—	—	—	—
	European Lunatic Asylum	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—	—
	Alipur Lock Hospital ..	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—	—
	Do. Jail Hospital ..	—	—	—	1	3	—	—	—	1	3	4	31	39	—	—	—	—	—	—	—	—	—
	Do. Police Hospital ..	—	1	—	1	1	—	—	—	—	—	—	3	6	—	—	—	—	—	—	—	—	—
	Do. Police Case Hospital	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	Alipur	14,804	25	—	126	42	1	—	1	10	—	11	161	366	1·6	—	·06	8·5	2·8	7·4	10·8	24·7	28·6
24	Khidderpur and Ekbalpur	15,340	8	—	145	74	1	1	—	8	—	9	331	568	·52	—	·06	9·4	4·8	·58	21·5	37·0	38·3
25	Watgunge and Garden Reach	26,836	30	1	187	121	—	1	1	4	—	6	288	633	1·1	·03	—	6·9	4·5	·22	10·7	23·5	24·5
	Total	212,998	208	11	2,193	1,487	11	5	8	104	4	121	3,597	7,628	·97	·05	·05	10·2	6·9	·56	16·8	35·8	42·2
	Canal	2,102	—	—	6	1	—	—	—	1	—	1	1	9	—	—	—	2·8	·47	·47	·47	4·2	14·3
	Grand Total ..	215,100	208	11	2,199	1,488	11	5	8	105	4	122	3,598	7,637	·96	·05	·05	10·2	6·9	·56	16·7	35·5	42·0
	Combined Total ..	681,560	665	85	6,060	3,074	192	29	48	331	4	12	9,855	20,343	·97	·12	·24	8·8	4·5	·60	14·5	29·8	35·0

Special causes of mortality: Fevers.—The mortality under this head in the town and suburbs combined, 6,060, was lower than it has been since the year 1889, which is satisfactory, as the mortality from this cause had been exceptionally high for some years, and it was feared that the increase was due to general deterioration of the town site rather than a cyclical wave of increased intensity. The added area and suburbs, which are ill drained and contain a large amount of stagnant water, were naturally the worst. The sewerage of the latter is being carried out, which may be expected to bring down the fever rate. The returns of deaths from fevers in 1898 were lower than they should have been, as after the appearance of plague many people registered deaths under "other causes" which would in other years have been registered under fevers. Surgeon-Major Ross and Dr. Daniel were working in Calcutta during the year on the mosquito hypothesis of the causation of malarial fever, and there appears to be now sufficient ground for basing practical measures on this hypothesis. I hope shortly to submit proposals for the employment of a few men in the extermination of mosquitoes in their breeding grounds. The cost will be small, and if it does nothing else it will add to the comfort of the people by removing a cause of irritation which is often the subject of complaint. If, as there is good ground for believing, it reduces the mortality from malarial fevers, which are the principal cause of the heavy mortality, especially in the suburbs, the health of the town will be manifestly improved at a much smaller cost than is entailed by any of the usual sanitary measures.

Cholera.—The mortality from cholera was below that of every year since the amalgamation of the suburbs with the town of Calcutta. The number of deaths was 665, against 2,181, the average of the nine years from 1889 to 1897, giving a death-rate of 0·9, against 3·2 per 1,000 of the population. Of these 665 deaths, 457 took place in urban Calcutta, falling short of the average of the preceding ten years by 895, and 208 occurred in the suburbs, falling short of the average of the previous nine years by 663. The figures for the two areas for the past eleven years are as follows :—

—	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
Town	1,734	1,079	963	1,553	1,257	596	1,118	1,302	2,377	1,543	457
Suburbs	—	1,236	916	1,402	762	273	577	797	1,072	806	208
Total	—	2,315	1,879	2,955	2,019	869	1,695	2,099	3,449	2,349	665

The mortality according to season is shown by the following monthly figures, namely:—

January.	February.	March.	April.	May.	June.
31	89	117	147	75	55
July.	**August.**	**September.**	**October.**	**November.**	**December.**
18	13	12	11	5	92

From these figures it will be perceived that the highest mortality was, as usual, in March and April. The mortality in December, however, was higher than is ordinarily the case. This was owing chiefly to a number of pilgrims for Saugor and Triveni succumbing to the desease in and about Kalighat on the way to and from their places of pilgrimage, and to their contaminating Tolly's Nullah near the ghâts, and thus communicating the disease to many residents visiting Kalighat to bathe, make offerings to *Kali*, and feast near Tolly's Nullah. Besides these imported cases, at least 30 fatal cases occurred in December amongst such visitors from other parts of the town.

Of the 665 cases, 101, or 15·1 per cent., were imported from places beyond the limits of Calcutta. The mortality was highest in Jorabagan, Burtolla, Shampooker, Bhowanipur, and Jorasanko wards, with 53, 52, 50, 44 and 43 deaths, respectively.

The cases were mainly isolated ones. In only a few places did the disease show any distinct tendency to localisation within small areas, and the cases which took place in such areas were generally few. Thus, in the Sabjibagan busti, Chetla Road, in Ward 23, there were four cases. The first was a girl of 12 years of the Bagdi caste, who was attacked on the 4th and died on the 6th February. No special cause was traced in her case. She contaminated a tank in the busti, and three other cases followed. They were all females of the Bagdi caste. One was a woman of 20, who was attacked on the 5th February and died the same day. The second was a girl of 8, who was attacked on the 7th February and died the same day. The last was a woman of 28, who was attacked on the 7th and died on the 9th February. A small outbreak occurred in the two adjacent bustis, 236 and 242, Upper Circular Road. The cases were all of conservancy coolies of Wards 2 and 5, and the original cause of the outbreak was probably the same in both bustis. The first case took place in busti No. 236, where one of the coolies of Ward 2 was attacked on the 14th April and died the same day. The attack was associated with the consumption of rotton sweetmeats obtained by begging from shopkeepers on the Bengali new year's day. The second case, also a coolie of Ward 2, was attacked on the 15th and died on the 16th April. The third and fourth were also coolies of Ward 2; one was attacked on the 16th April and died the same day, the other was attacked on the 16th and died on the 17th April. In busti No. 242 there were two attacks on the same day that the last case in busti No. 236 died. The first was a coolie of Ward 2, who was attacked on the 17th April and died the same day; the second, a coolie of Ward 5, was attacked on the 17th and died on the 23rd April. In busti 64, Machuabazar Street, there were four attacks on the same day and all of either the Chamar or the Dosad caste. From the history it would seem that they had been feasting together, but no distinct cause of attack could be made out. The men were attacked on the 10th May, and three of them died on the 11th, and the fourth on the 12th May. At 66, Kansaripara Road, in Ward 22, there were three cases, all Mahomedan boys between 5 and 10 years of age. The first was a boy of 5, who was attacked on the 10th December and died on the 14th. The cause of attack would seem to have been polluted drinking water supplied by a Bhisti in his skin bag, with which he had been carrying tank water for watering roads. This patient contaminated a foul tank which directly communicated with another, and thus two more cases took place close to those tanks. One was a boy of 10 years, attacked on the 11th December, who died the same day; the other was a boy of 9, who was also attacked on the 11th and died on the 15th December.

Small-pox.—As regards the prevalence of small-pox, the year 1898 is to be regarded as a non-epidemic one, the number of deaths recorded from this cause being 85, against 161 in the previous year, and against 577, the average of the preceding five years. The disease occurred in all the wards excepting Waterloo Street, Hastings, Baniapookur, Ballygunge, Bhowanipur, Alipur, and Khidderpur. Except for two cases in Entally in March and five in Watgunge in December, the disease may be said to have been confined to the old town and canal area. Small-pox was present in Calcutta during all the months of the year except October. The town would have been likewise free from the disease during September and November were it not that two cases which had occurred in Shampookur in August ended fatally in September, and a fatal case occurred in the same locality in November, and that two cases were imported from Hong Kong in September, and being admitted in the small-pox hospital recovered.

As in ordinary years, the prevalence of the disease was in the form of an outbreak, which, commencing from the close of the previous year, attained its height in March and April and practically ended in August, and which was followed after an interval of about three months by the commencement, in the month of December, of a fresh outbreak, which attained its full force in the following year. 142 cases of small-pox came to notice in the course of the year 1898, of which 85, or 59·4 per cent., proved fatal. Of the 142 cases, 33, or 26·7 per cent., were vaccinated, 4, or 2·8 per cent., were inoculated, and 88, or 61·9 per cent., were unprotected, while in 12, or 8·4 per cent., the condition as regards previous protection could not be ascertained. The mortality among the vaccinated cases was 44·9 per cent., among the inoculated 100·0 per cent., and among the unprotected 63·6 per cent.

Dysentery and Diarrhœa.—The mortality from dysentery and diarrhœa was higher in 1898 than the average of the previous nine years. The number of deaths was 3,074, against 2,896, the mean of the nine years from 1889 to 1897, giving a death-rate of 4·5, against 4·2 per thousand of the population. Of the 3,074 deaths, 1,586 occurred in the

town, exceeding the average of the previous decennium by 190, and 1,488 took place in suburbs, exceeding the average of the previous nine years by 26.

Other Causes.—It has been shown that the mortality under the special heads of cholera, small-pox, and fevers was much below the average. The mortality registered under "other causes" was, however, above the average, being 10,268, against an average of 8,560, giving a difference of 1,708. Of some of the principal causes of this increase, the deaths registered under phthisis were 431 more, those under asthma 617 more, and those under bronchitis 191 more than last year.

Vaccination.—Vaccination against small-pox was carried on by the Municipal Vaccination Department during the greater part of the year 1898. Soon after the declaration of plague in Calcutta, and the introduction of preventive inoculation against plague, some of the vaccinators were mobbed and assaulted, and the Chairman on the 3rd May stopped all vaccination work for the time being, so that from the 4th May to the 21st July there was practically no vaccination done, the work being confined to the houses of a few respectable Native gentlemen where small-pox occurred. From the 22nd July, although the work was resumed, there were no applications for vaccination at the stations, and the vaccinators were afraid to go to the bustees for fear of being molested. The Deputy Superintendent of Vaccination was therefore obliged to accompany them to the bustees and explain to the people that they had nothing to do with the plague inoculations, and being well known to them, persuaded some to have their children vaccinated in their own houses, these first persons persuading others to bring their children to the stations. In this way the normal state of things was gradually attained.

The total number of persons vaccinated during the year was 13,255, against 21,620 in the previous one. Of these, 11,569 were primary and 1,686 were re-vaccinations, against 13,297 and 8,323 respectively in 1897, thus showing a decrease of 1,728 primary and 6,637 re-vaccinations. The decrease of primary operations was mainly due to the removal of a large proportion of the residents from the town during the plague scare, and also to the comparative immunity from small-pox during the year. The very small number of re-vaccinations done in 1898 is to be ascribed to the latter cause alone. Besides the above numbers, which show the work done by the Vaccination Department of the Corporation, 158 primary and 2,190 re-vaccinations were performed by Government officers of the Animal Vaccination Department, Calcutta, in private European houses, and in public institutions, such as hospitals, jails, asylums, &c. Were these figures combined with those shown in the returns of this department, the total number of primary and re-vaccinations done in Calcutta during the year 1898 would amount to 11,727 and 3,876 respectively.

Of the 11,569 primary operations, 10,931, or 94·48 per cent., were successful, 91, or ·17 per cent., were unsuccessful, while in 547, or 4·7 per cent., the result could not be ascertained. The rate of success, calculated on the ascertained cases, was 99·07, against 97·59 in the previous year. Of the 1,686 re-vaccinations, 244, or 14·47 per cent., were successful, 656, or 38·91 per cent., were unsuccessful, while in 786, or 46·6 per cent., the result was not ascertained. If the unknown cases are excluded from the total, the rate of success in the re-vaccinations was 23·68 per cent., against 16·51 in the previous year.

Of the total of 13,255 persons vaccinated, 7,117 were males and 6,138 were females. According to nationality, 9,247 were Hindus, 3,473 Mahomedans, 425 Christians, and 110 of other classes. Considered according to age, 3,198 were under 1 year, 8,025 1 year and under 6 years, and 2,032 were 6 years and over. Of the 11,569 primary operations performed in 1898, 7,907 were Hindus, 3,253 Mahomedans, 304 Christians, and 105 other classes; while 3,198 were under 1 year, 8,025 1 year and under 6 years, and 346 were 6 years and over.

Primary vaccination is carried on in Calcutta under the Compulsory Vaccination Act, which provides that the parent or guardian of a child is to get it vaccinated within one year from birth, and that if on the expiration of that year the child is found unvaccinated the parent or guardian may be prosecuted, and an order obtained from a magistrate for the compulsory vaccination of the child. The procedure which is accordingly adopted is for the Registrar of Births at the time of registration to issue a notice to the parent or guardian of the child to get it vaccinated within 12 months from the date of birth, and to send a corresponding notice of the birth to the Vaccination Department, and for the Vaccination Department as soon as possible after the child has been vaccinated to grant a certificate showing the result of the operation, and to send a corresponding certificate to the Registrar of Births for record. When twelve months have elapsed from birth, if the child is found unvaccinated, though in a fit state to be vaccinated, prosecution is instituted

against the parent or guardian under the powers conferred by the Amended Vaccination Act. Moreover, house-to-house enquiry is made for unprotected persons by the male and female vaccinators of the department, and for every person over one year of age who is found unprotected, and who, or whose parent or guardian, refuses to have vaccination done, a notice is issued to have the vaccination performed within 15 days from the receipt of notice, and, in default, the party responsible is prosecuted. The unwillingness of the majority of the residents of the town to have their children vaccinated until they are at least a year old, and the fact that the law allows them to do so, have been brought to notice in previous reports, but unless the statutory period for compulsory vaccination is reduced the protection of the infant population cannot be secured. In the year under report there were 17 cases of small-pox reported under one year of age, of which 13 ended fatally.

Vaccination was performed during the year 1898 with lymph obtained either direct from vaccinated calves, of which the department received a supply of 446 in the course of the year from the Government Animal Vaccination Depôt in Calcutta, or with lanoline vaccine paste received from the same source. The paste was found very convenient for vaccinating poor people at their own houses who were unable to pay any charge for vaccination. It was also used in the stations during the greater part of the hot and rainy seasons, when the attendance was very limited, and where it was found very expensive to have the operation done from calf to arm. In a very limited number of cases humanised lymph was also used in the houses of orthodox Hindu families, or amongst people who had objections to the use of the calf lymph.

The following table shows the comparative rates of success in primary vaccination obtained from the use of calf lymph, lanoline paste and humanised lymph, respectively :—

—	Calf lymph.	Lanoline paste.	Humanised lymph.
Total No. vaccinated	3,736	6,384	24
No. in which result was ascertained	3,488	6,211	24
No. successful	3,463	6,166	24
Rate of success per cent. on ascertained cases	99·2	99·2	100.0

At present lymph calves are conveyed in common hackney-carriages from the Animal Vaccination Depôt to the Vaccination Stations and other places where people have to be vaccinated. But this system is objectionable for two reasons. First, the use of public hackney-carriages for carrying vaccinated calves is very undesirable, as they cannot be easily or completely disinfected in a short time, if at all, and we cannot expect the man who supplies them not to use them for any other purpose. Secondly, for the supply of such carriages we have to depend upon a contractor; and if he fails us we find it difficult to get carriages. To obviate this difficulty a proposal was submitted to the Commissioners in March for the construction and equipment of four specially constructed carts for the conveyance of calves, which has not received sanction.

ABSTRACT OF THE REPORT OF THE MADRAS MUNICIPALITY FOR 1898-99.

(*R. E. Ellis, Esq., Acting President.*)

Births and Deaths.—The total number of live-births registered during the year 1898 was 18,694, against 18,702 in 1897, showing a decrease of 8. The ratio per 1,000 per annum calculated on the census population of 1891 was 41·3, the same as the previous year. The decrease is without doubt due to the hard times, the price of the staple grains remaining very high till towards the close of the year. The number of still-births registered during the year was 384, a proportion of 2·0 still-births to every 100 born alive. No doubt there is still considerable concealment owing to popular prejudices, and dead children are easily got rid of in this country. The male births numbered 9,721 and the female 8,973, giving a proportion of 108·3 males to 100 females.

According to caste the birth-rate among the Mahomedans was 42·9 per 1,000 ; among the Hindus, 41·5, and among the Christians, 37·7.

Mortality.—During the year 1898 there were 20,286 deaths registered in Madras, giving a death-rate of 44·8 per 1,000, calculated on the census population of 1891, against 16,086, or a ratio of 35·5, in the previous year, the average for the decade being 17,976·9. In 1897 the number of births was greater than the deaths by 2,616, and in 1898 the number of deaths was greater than the births by 1,592. Of the 20,286 deaths registered, 9,953 occurred among males and 10,333 among females, giving a proportion of 96·3 to 100.

The number of deaths according to nationality was: Europeans 99, Eurasians 472, native Christians 892, Hindus 16,449, Mahomedans 2,368, and others 6. The ratios per 1,000 are 36·8 among Christians, 45·8 among Hindus, 44·5 among Mahomedans, and 10·0 among "others," against 29·7, 35·7, 38·7, and 13·4 of the previous year.

During the year under report the number of deaths from fevers was 5,489, against 5,484. The deaths from fevers were practically the same as in 1897. In October the numbers registered suddenly showed a great decrease, which was attributed to the public fearing investigation on account of plague if they said that a relative died of fever, so they assigned the death to some other cause. The total mortality was higher than it had been for some years. No definite cause can be assigned for this, after the exclusion of a large number of cholera cases. A close investigation was made by the order of Government to ascertain whether concealed plague had anything to do with it, but it was satisfactorily determined to be due to the operation of general causes combined with a small epidemic of cholera. The deaths from "Measles" and "Diarrhœa and Dysentery" have risen high, *i.e.*, from 410 to 775 and from 2,000 to 3,302 respectively. But the mortality from small-pox remained almost the same, viz., 116 against 114, while cholera rose from 169 to 778, the highest recorded since 1891. Seven deaths occurred from plague.

Small-pox.—The total number of deaths registered in 1898 from small-pox was 116, against 114 of the previous year. The small-pox of 1898 was a continuation of that which commenced in the beginning of 1897. The incidence on the vaccinated and unvaccinated is shown in the following table :—

——	Attacks.	Deaths.	Fatality.
Unvaccinated	175	50	28·6
Said to be vaccinated but no marks	104	40	38·4
Vaccinated	177	26	14·7
Had previous attack of small-pox	4	—	—
Total	460	116	25·2

——	Total deaths.	Under 10 years.	10–20.	Over 20.
Unvaccinated	55	43	6	6
Vaccinated	23	14	4	5

Cholera.—The outbreak was by no means of a sudden nature. Cholera was prevalent in the city in a sporadic form throughout the year 1897. On looking over the weekly proceedings of the Board of Health it is found that, after a comparative freedom of several months from cholera, two fatal cases were reported in the week ending with 11th June, 1897, of which one was said to be imported. Thereafter every week furnished some deaths from cholera under the sporadic column, and in September, 1897, during the week ending with the 3rd, the disease even assumed epidemic proportions. Two parcherries, one in the 1st and the other in the 8th division, were the chief centres then affected. This sudden rise in the number of deaths from cholera lasted but a week, yet during the months of October, November, and December cholera continued in a sporadic form. With the advent of the new year, 1898, a change for the worse came on, the number of deaths gradually swelled up, so that in January and February alone there were reported 99 attacks, 67 deaths. This again came down, and during the months of March, April, May, and June there were but 19 deaths reported. This temporary cessation was followed by the outbreak in July, 1898, which continued throughout August, when it was at its height, and September. The highest number of deaths reported in the present outbreak in any one week was 91 for the week ending with 19th August, 1898. When the north-east monsoon set in with full force cholera gradually abated, so that in November and December only 46 and 19 deaths respectively were reported, but it was not until February, 1899, that the city became entirely free. The total number of deaths from cholera in 1898 is 778, and the highest number recorded in any one year since the severe epidemic of 1891, giving a ratio of 1·7 per 1,000.

Plague.—During the year seven deaths occurred from plague, against two in the previous year. All of them were imported ones.

Measles.—The number of deaths registered from measles was 775, against 410 in the previous year, the highest recorded since 1893.

Bowel Complaints.—Under the heads of dysentery and diarrhœa there were 2,750 and 552 deaths registered in 1898, against 1,496 and 504 of 1897.

Infantile Mortality.—There was a visible rise in the rate of infantile mortality during the year under report, from 369·9 deaths to every 1,000 births of 1897 to 404·2 deaths to every 1,000 births in 1898. This can only be accounted for by the general ignorance of the masses in matters relating to management of birth and infancy, coupled with the existence of insanitary conditions and overcrowding in many parts of the town. The total number of deaths for the year registered under this head was 5,525, against 5,052 of last year.

The Price of Food.—The price of food during the year became dearer than in 1897, and continued to remain so till toward the close of the year, causing great distress to the poor classes and exercising a potent influence on their mortality.

Meteorological Conditions.—The Government Astronomer reports as follows :—" Temperature—was below average in January, March, September, and October ; it was normal in November, and above average during the other months. The highest shade temperature recorded was 109·8° on May 9th, the lowest was 59·8° on February 3rd. Rainfall was below average in January and from March to July, and above average in the other months. The excess for the whole year was 19·12 inches. The rainfall during the period 15th October to 31st December was 43 inches, against an average of 26, and a fall last year of only 9½ inches. The greatest fall on one day was 5·65 inches on December 26th."

Vaccination.—During the year 1898–99 the total number of cases vaccinated was 28,186, showing a decrease of 4,896 cases when compared with the year 1897–98. The decrease is accounted for to the less prevalence of small-pox during the year under review, and to the non-vaccination of emigrant coolies, the Natal Emigration Depôt at Cassimode having been closed from November, 1898, on account of plague. When contrasted with the year 1896–97, the work performed during 1898–99 shows an increase of 1,165 cases. Out of 28,186 cases vaccinated there were 16,372 males and 11,814 females. Of the total vaccinated, 25,066 were successful, 1,099 unsuccessful, and 2,021 unknown. The large number of unknown cases was due to the convicts of the Penitentiary undergoing short terms of imprisonment of from 3 to 5 days having been released before inspection of the result. Also to the emigration coolies of the Natal Depôt who, after

vaccination, were rejected as being physically unfit before the results of vaccination could be ascertained.

During the year 1898–99 the revised bye-laws, dated 22nd February, 1898, were put into operation from the beginning of the official year. Under bye-law 5 the parents were bound to produce the vaccinated children for the inspection of the vaccinator. Out of a total of 28,186 cases vaccinated in the depôts, 9,740 cases were brought to depôts for inspection, as required in the memorandum, and in 15,922 cases the parents were reminded and warned to take their children to depôts in order to minimize the prosecutions for failing to comply with the bye-laws. Those cases vaccinated in the Penitentiary and Natal Emigration Depôt, viz., 2,724, were verified by the Deputy Inspector.

The percentage of success, both in primary and re-vaccination, excluding the unknown cases from the total, was 95·79, showing a decrease of ·97 per cent. below the year 1897–98, and it was due to the low percentage of success obtained in re-vaccination.

The following table shows the result obtained in both primary and re-vaccination as compared with the year 1897-98 :—

Year.	Primary Vaccination.				Re-vaccination.			
	Successful.	Percentage.	Unsuccessful.	Unknown.	Successful.	Percentage.	Unsuccessful.	Unknown.
1897-98	24,335	99·56	106	387	6,091	86·97	912	1,251
1898-99	20,147	99·48	105	375	4,919	83·18	994	1,646

Out of 28,186 cases vaccinated, 1,351 were Europeans, East Indians, and native Christians, 2,587 Mahomedans, 24,237 Hindus, and 11 other castes. Of the total vaccinated, 20,627 were primary vaccination, against 24,828 in 1897–98, showing a decrease of 4,201 cases. The percentage of success in primary vaccination was 99·48, showing a small decrease of ·8 per cent. against 99·56 in 1897–98. Among adults 7,559 re-vaccinations were performed, with a percentage of 83·18 of success, against 86·97 in 1897–98, showing a decrease of 3·79 per cent. In G.O., No. 484 M. Mis., dated 13th April, 1899, par. 4, it has been pointed out by the Sanitary Commissioner that the rate of success arrived at after inspection of 1,000 cases of re-vaccination was between 75 and 60 per cent., which is considered a fair percentage. The attention of the vaccination staff has since been drawn to the remarks of the Sanitary Commissioner.

During the year 13,643 infants were vaccinated, against 15,323 in 1897–98, showing a decrease of 1,680 cases, with a percentage of 99·58 of success, against 99·70 in the previous year. Out of 28,186 cases vaccinated, 13,643 were infants under one year, 6,669 above one and under six years, and 7,874 above six years of age.

Plague Measures.—When the plague broke out in Bangalore, at the instance of Government a scheme of defence for the City of Madras was drawn up with the aid of the Sanitary Commissioner, and immediate steps were taken to carry many of its suggestions into effect. The number of municipal hospitals was increased from two to four, and everything made ready in all of them for immediate occupation.

Government having sanctioned the formation of caste hospitals by the leaders of various communities to provide for those persons, who, from religious or other motives do not care to become inmates of the municipal hospitals, meetings were organised and held by the Commissioners with the object of explaining the situation to the population, and collecting funds to defray the cost of erecting or leasing suitable buildings for the purpose. Government agreed to pay half the cost of establishment and maintenance in each case, after formal approval of the site and general arrangements.

The outcome of the movement was—

(1.) A caste hospital, fairly completely equipped, for Brahmins in Edward Elliot's Road, 8th Division.

(2.) A Gosha hospital, with segregation building adjoining, in Peter's Road, 7th Division, also complete.

(3.) A camp hospital for Brahmins on the beach, 7th Division, as yet uncompleted.

(4.) A Persian hospital in Tondiarpet, 1st Division.

(5.) A promise from Rajah Sir Savalay Ramasawmy Mudaliar, to bear half the cost of a general hospital in each division—one was begun in 4th Division.

(6.) Sites were chosen or looked for in several other divisions by other communities.

Owing to the cessation of the Bangalore outbreak further action seemed unnecessary at the time, as the danger of an epidemic here became considerably less, but enough had been done to show the readiness of the people to help to provide for themselves in a time of need.

Segregation Camps.—No new camps were put up, partly because the existing accommodation was sufficient to meet the first rush, and partly owing to the resolution of Government exempting from segregation all persons who had been inoculated, which, it was anticipated, would be freely resorted to.

The small camp opposite Perambur station is used for the detention of travellers from infected areas who fail to give satisfactory addresses on arrival. The number of persons thus detained during the year was 498. All cases arriving by train with fever or other suspicious symptoms are sent to the Perambur hospital for observation.

Several sites have been selected for the erection of health camps in case it became necessary to evacuate any seriously infected district, but only one has been put up as yet —on Pudupet plain, though materials are kept ready for immediate use in three other places.

Four military officers were put on special plague duty by the Government in the month of September, their instructions being to supervise and be responsible for the proper working of all plague measures in their respective districts, including the disinfection of houses and tracing of contacts. Each officer had a gang of 25 sepoys who had been trained in disinfecting by the Sanitary Commissioner. One batch was camped in the compound of the Wallajah Road Police Station, where the plague officer also had his office, another in the compound of the Vepery segregation camp, and the rest on the Washermanpet maidan. These men were supplied with all the necessary apparatus for disinfection, and, on a case being reported, they proceeded to the house and assisted in the removal of the contacts to the camp, afterwards disinfecting the premises.

Each plague officer had also a clerk, peons, &c., and a bicycle, that urgent messages might not be delayed. As there was practically no work in the beginning they undertook the supervision of the parcherry cleaning gangs, which were specially instituted for the purpose of cleaning up as far as possible all the dirtiest spots in the city before the advent of plague. After the cleaning, the houses of those persons who could not afford to do it themselves were whitewashed gratis, and notices were served on large numbers of those who could afford it. Leaflets were distributed all over the town calling upon the residents to clean and whitewash their premises, to which many responded.

Work done—	1st Division	... 7,134 rooms	whitewashed.
	2nd and 3rd Divisions ...	... 2,334 huts	,,
	4th, 5th, and 6th Divisions ...	... 592 houses	,,
	7th and 8th Divisions ...	... 1,174 houses	,,

In March, as the danger of an outbreak was not so imminent, 75 of the sepoys were sent back to their regiment, and 25 only were retained for emergencies.

During the first half of the year the system of surveillance which had previously been in force was continued. All passengers from infected areas had their names and addresses taken at Perambur station, and the slips were distributed among the Sanitary Overseers, who visited them daily in their homes for ten days. Persons who did not know where they were going were either detained for 10 days at the Perambur camp or were accompanied by coolies till they had fixed on a residence. The system worked fairly well, only a small proportion of the travellers escaping observation, but it gave the Overseers in the more thickly populated wards a great deal of additional work, and was necessarily somewhat detrimental to their ordinary duties.

When the plague broke out in Mysore, the number of persons coming to Madras from infected districts was enormously increased in consequence of the proximity; and the passport system was introduced all over the Presidency.

All persons arriving by train from places notified to be infected were required to procure a passport at Perambur, which bound them to present themselves before an Inspector daily for 10 days. If they failed they were liable to prosecution. To meet the increase of clerical work at Perambur several writers were appointed, and to observe the passport

holders in the city seven Plague Inspectors having the qualification of Sanitary Inspector or Hospital Assistant were established either in the offices of the divisional registrars or in police stations. It was the duty of these inspectors to sign up daily all passport holders who presented themselves during their office hours ; to keep a register of the same ; to intimate to District Collectors the departure of any of their clientèle before the expiry of the observation period ; to hunt up all absentees and defaulters at their addresses, and to visit daily at their homes persons who have been exempted by reason of illness or otherwise from attending the plague office. Defaulters were prosecuted by the Divisional Sanitary Inspectors. The system worked fairly well, but, of course, a certain percentage of arrivals altogether escaped observation, and could not be traced either by the sanitary staff or the police. It is good luck alone that has saved the city from indigenous cases, which might very well have followed, if one of those persons who eluded the utmost vigilance manifested had developed plague and died unknown.

It will be noticed that after the Bangalore outbreak the number of possibly infected travellers arriving rose, and again when Vellore and its neighbourhood became infected there was a still further increase. So greatly indeed was the work of the Plague Inspectors in some districts, notably the 2nd, 5th, and 7th, increased that they had to be relieved by assistance from the sanitary staff and the Hospital Assistants under the orders of the plague officers. In addition to the seven Plague Inspectors two nurses were engaged, one for Northern Range and the other for the Southern Range, to see at their homes all gosha women and other females who had an objection to leave their homes. The number of passport-holders who could not be traced was about 4 per cent. of the total number of passports issued.

Further precautions included a daily scrutiny of the mortality all over the town, coupled with minute enquiries into every case in which two or more deaths had occurred in one house at short intervals of time. The sanitary staff also had orders to enquire into the cause of every death that they happened to hear about, and to immediately report any suspicious circumstances. All cases of illness amongst passport-holders were at once reported and investigated by some one competent to give an opinion.

A good deal of inconvenience was caused to persons who were constantly travelling and to railway employés. The former class were to a great extent relieved by the G.O., which allowed all persons possessing a properly authenticated inoculation certificate to go free without being subjected to surveillance, and the latter by the issue of permanent passes, the railway authorities having agreed to immediately report all illness among them.

Passport-holders among the railway employés of the Madras Railway were examined by the Railway Medical Officer, those going to Fort St. George by the Fort Surgeon, and to regiments by the Regimental Medical Officers. Persons under the treatment of qualified medical practitioners had their passports signed by them. Considering the annoyance and inconvenience of attending the Plague Inspector's office daily, especially when it seemed to the individuals concerned that they had not come from an infected spot, the general public must be congratulated on the way they have submitted themselves to regulations which were enforced for the good of the community.

The issue of passports to arrivals from Calcutta was undertaken by the Port Health Officer and the daily examination by the Municipal Plague Inspectors. All coolies working on ships from infected ports were disinfected before being permitted to return home, and any absentees from work were visited at their homes by a Hospital Assistant to make sure that their absence was not due to plague contracted on board the infected vessels.

The question of examining all arrivals by road at the toll-gates was discussed and fully considered, but abandoned as impracticable ; and reliance had to be placed on the arrangements made by the District Collectors for preventing foot-passengers from conveying the disease.

The issue of passports to travellers by the S.I.R. was conducted at Chingleput station, since it was considered that Madras would be thereby more effectually protected than by issuing them at Chetput or Egmore.

Judging that if a large number of the rodent population of the town, which undoubtedly are most prone to the attack of the plague, could be destroyed before the disease became indigenous, a large quantity of pabulum eminently suited to the needs of the plague bacillus would be removed, and fewer chances given it to develop and be distributed, it was determined to offer rewards for each dead rat, bandicoot, and mouse produced. The Commissioner of Police kindly undertook the distribution of the money at the different Police Stations, and after the tail of each animal had been cut off to

prevent its subsequent production as a claim for pies it was put in a bucket. These buckets were twice daily removed to the rubbish depôts, and their contents cremated in small iron incinerators.

Towards March, 1899, it was seen that the numbers killed did not show any tendency to diminish; it is obvious, therefore, that it was more or less hopeless to make any permanent impression on the total rodent population. Added to this there was some suspicion that persons might be induced to breed them for the sake of the reward, and it was known that field rats were constantly being brought in. So the reward was reduced to one anna a dozen to see what the effect would be before ceasing to offer it altogether.

During September inoculation with Haffkine's Prophylactic was begun in the Health Office, the object being to protect first of all the sanitary staff before the rush came, that their work might not be interfered with. A little later two public demonstrations were given in Triplicane to familiarise people with the process, and show that it was not necessarily followed by death or permanent disability of any sort. One or two of the Commissioners took the matter up, and having been operated on themselves to give confidence to the crowd, persuaded many other people to come forward. Several public lectures were given on inoculation by the Sanitary Commissioner and Deputy Sanitary Commissioner, and the times and places where people could be inoculated were freely advertised. At first the Deputy Sanitary Commissioner, Major Bannerman, I.M.S., performed most of the operations, but when the numbers applying for protection became too high, the four English Plague Medical Officers lent by Government to the Municipality relieved him. A Lady Apothecary, Mrs. Huffton, was appointed to inoculate gosha and other females at their homes.

The outlook cannot be considered to be very bright. Plague is indigenous within 80 miles of Madras, and though the number of cases has not been very great, yet there is good reason for fearing that they will become more numerous in course of time. No reliance can be placed in the theory, which seems to find favour in the eyes of many, that plague cannot flourish on the east coast and that if it does establish itself in Madras the result will not be serious; nor can the precautions taken, carefully devised and zealously put into execution though they be, be deemed a full and sufficient safeguard against an invasion, for loop-holes of escape are to be found in every part of the system depended on. Despite passports and police plague may arrive by rail; notwithstanding the vigilance of Moffussil officers it may enter unknown by road, rats and infected merchandise can introduce it without any one being the wiser. Fortune has so far favoured us, and all the imported cases have been brought to light, but one day she may fail, and he is bold who would dare to say how Madras would fare.

Sanitary Defects and Sanitary Progress.—The Mylapur drainage system has been opened during the year and there can be no doubt that it is on the whole a great success. It is now possible to keep the streets clean and free from very offensive smells, and the gain in dryness of the soil will surely be made evident in the course of a year or two by a diminution of sickness and lowered death-rate. It remains now to connect some outlying parts as Robertsonpet and Kosapet with the system.

Steps are being taken to provide for the drainage of other quarters also, which may possibly be begun before the year is out; and not a moment too soon, for sewers to carry off waste water are by far the most urgent need of Madras at the present. It is true economy to spend money freely on works that will in future be indirectly most profitable. To give an idea of the insufficiency of the present system of sewers it is roughly calculated that about 4,200,000 gallons of sewage are daily disposed of on the existing farms and by drains discharging into the sea. Now the amount of pipe water supplied daily is about 8,210,000 gallons without counting the quantity raised from wells which cannot be estimated. The difference, about 4,010,000 gallons, daily soaks into the soil, except such quantity of it as may be evaporated. Can it be wondered that Madras is damp, swarms with mosquitoes, is a hot bed of malaria, and that the subsoil water level is very high? Of course a good deal of this surplus is utilised without offence in watering the grass and trees of private premises. Some flows into the Cooum and some into tanks, but the fact remains that an enormous quantity is not disposed of at all.

The new sewer in Sydenham's Road has tapped the drains that used to fertilise People's Park, and removed a smell that was the cause of frequent complaints, but, in doing so, more sewage is of necessity pumped on to that water-logged area near DeMellow's Road, the effluent reaching the Buckingham Canal and flowing around one of the water mains on its way.

A new drain was opened at Royapuram which discharges into the sea. This gets rid of a good deal of sewage without nuisance, but at first gave a great deal of trouble by the mouth becoming blocked by sand and the valve being broken by the waves.

For the rest, there has been no important change, some of the sewage being disposed of on farms as before, the remainder soaking into the ground.

There is extreme difficulty in getting night-soil put into night-soil carts and not into rubbish carts, especially in Black Town, since the scavengers make money by the latter procedure. A large number of extra conservancy carts were sanctioned during the year, chiefly for night-soil. It is in the 1st, 2nd, 3rd, and 7th Divisions that the removal of night-soil is so defective. Even though there will shortly be enough carts, it is doubtful whether complete success will be achieved for some time to come, owing to lack of scavengers and proper drivers, and the absence of all power over this class of persons. They strike work whenever it seems good to them, and often on account of events which are in no way connected with the municipality, but have originated in private quarrels or differences with the police. Government has been addressed on the subject of a labour law, but no decision has yet been obtained.

Twenty-four Conservancy Overseers were temporarily appointed on a salary of Rs. 15, whose sole duty is to attend to the better working of the carts and coolies, but so far the improvement has not been very noticeable, and it is probable that many of them will before long be dispensed with. The range of the Sanitary Overseers' work should be considerably enlarged by providing them with bicycles to be paid for on the monthly instalment system, and it is hoped they will all avail themselves of the opportunity.

Many streets and lanes are made almost impassable by people committing nuisance, especially in 1st Division. This is not wholly for want of latrine accommodation either public or private, for all open places are fouled whether a latrine is handy or not; and children and servants are habitually sent to defecate outside a house by the owner thereof, even though it has a latrine attached. Housewives are as contumacious as ever in the disposal of their refuse, which leads to the very untidy appearance of so many Black Town streets. Those who do not fling it into the street just outside their houses treat the dust-bin merely as a sort of indication of a spot near which rubbish may lawfully be thrown.

The water supply still requires to be filtered before distribution, to remove suspended vegetable matter. There are several places where the main pipes run above ground, and are at times immersed in very foul water and the drainage from rubbish depôts. In other places the delivery pipes run through cross underground drains at right angles, which not only exposes the water to the possibility of contamination, but also affords an obstacle to the passage of floating leaves and debris, which constantly collect at that point and completely block the lumen of the drain. During the latter part of the year many of the branch pipes were raised and cleaned. The accumulated deposit in some cases had almost obliterated the lumen of the pipe, and was found on examination to consist of earthy matter, oxides of iron, &c., together with various animal and vegetable remains, living leeches, and a few dead fish. Of course the supply reaching the houses was greatly increased in quantity and probably also improved in quality by the process.

A certain number of dirty and useless wells were closed during the year, and steps taken to prevent new ones being dug in populous quarters where pipe water could be easily supplied. The well of the Brahmin choultry in Poonamallee Road, known as the "Egmore well," is still held by many to be the best water obtainable in Madras. The Chemical Examiner styles the water "usable." Bacteriologically nothing about it is known. No doubt the water is good, otherwise it would not have acquired such a reputation, but it is most liable to contamination on account of the numberless dirty chatties and vessels lowered into it by the water carriers of the 120 or so houses and institutions that use it, exclusive of casual visitors. The religious beliefs of the frequenters of the choultry forbid them to drink pipe water, so it cannot be closed.

A crusade was inaugurated against the dhobies to prevent them from washing in foul and stagnant water, and to compel them to provide proper and separate places for storing clean and soiled clothes apart from their living rooms. Some literature on the subject was distributed among them. Great improvements could not be affected, owing primarily to their poverty, and secondly, to passive opposition and ignorance of what is wanted and of the necessity for changing their ways. Some years must pass before the dhobies as a whole can be educated up to the modern standard. Meanwhile there remain but few places in which they can be recommended to wash except wells, and there the labour of drawing water is a serious drawback. If only some public-spirited individual would start and superintend one or more dhoby khanas, established and worked on cleanly and

sanitary lines, he would be a benefactor to all Madras. It is hoped that the municipality will be able to provide for a small experimental one in Chetty's Gardens, Triplicane, where there is an unused slaughter-house fit for the purpose, during the current year.

Many market owners were compelled to repair and improve their markets. In several there is now little that can be desired, but nearly all suffer from lack of supervision on the part of the owners over the stall-keepers, who are allowed to block the gangways and generally to make as much mess as they please. The Kotwal Bazaar has begun to put improvements in hand and bids fair, if the problem of control over the stall-keepers can be successfully overcome, to be a pattern institution. The new Municipal Market in the People's Park is rapidly progressing and will probably be a great success, as many applications for stalls have already been received. A beef stall is badly needed for the Smithfield Market, the present arrangement of a dirty shed on a piece of open land being objectionable from every point of view.

Private cattle-yards still are a source of great public danger. Poverty prevents many necessary alterations being carried out, but it is an open question whether a man, who keeps ten cows in a filthy yard and pleads poverty when called upon to pave and drain it, can be justified in his action. Should he rather sell four cows, pave his yard with the proceeds, and keep the other six in a decent way? Many consumers of milk would revolt if they saw it being drawn from the indescribably filthy udder of a buffalo cow, by the almost equally unclean hands of the milkman, into a vessel which has been placed on the ground, reeking with dung and urine, of a close and overcrowded cow-shed. The milk cannot, under such conditions, fail to be contaminated with every pathogenic organism that happens to be present. Public cattle-yards, where a man can rent a few stalls, are badly wanted.

The question of the erection of one or more "infectious diseases hospitals" was again under consideration, and a committee was appointed by Government to decide what could be done.

Great care has been exercised in seeing that the plans of all buildings submitted are properly arranged with regard to sanitation, and many cases have been discovered in which the builders have entirely disregarded the instructions given. The type of plan for native houses is fundamentally wrong; it is almost impracticable to ventilate them properly. Love of privacy and dark corners outweighs all hygienic principles; but, while the privacy of a family is in the abstract to be encouraged, yet, when it goes to the length of excluding all light and air, it begins to merit condemnation. There is a growing tendency to construct long rows of dark and unventilated dwellings for the poor, having regard only to the number of rooms that can be got into the space available, which must be guarded against. There is rarely any adequate provision for bathing-places in private houses, and some public ones to suit all castes are greatly needed.

The work of cleaning covered drains, which had hitherto been performed by contract, was undertaken departmentally by the Health Department and a temporary staff engaged for the purpose in charge of three Special Superintendents. One gang was attached to 7th and 8th Divisions, one to the 5th, and one to the 1st, 2nd, and 3rd. It has also been found necessary to keep a special staff to clean the Mylapur Sewage system and preserve the house connections in good order. The new arrangement has been found to work well, more has been accomplished in a shorter time, and prompt attention could be given to any urgent work. Moreover, many underground drains, the existence of which was previously unknown, have been discovered.

The flushing of drains, inaugurated on account of plague, was also transferred to the Health Department on April 1st, 1898, and the work supervised by the Sanitary Inspectors. The monthly expenditure was thus reduced from £180 to £94 without any loss of efficiency.

Without trying to be too up-to-date and to introduce innovations and modern improvements before either the time is ripe or the general public are sufficiently advanced in their requirements to render them successful, or even desirable, it may fairly be held that the opportunities for the advancement of knowledge and the means for scientific investigations of the most elementary character are further removed from realisation than should be the case in a city of the size and importance of Madras. For example: (*a*) Haffkine's anti-cholera inoculations have been proved to be of immense value, yet they cannot be practised here for lack of material. Who can say with certainty that there are weapons enough at hand to combat a widely-spread outbreak of cholera, such as might occur any year. To Hankinise all the wells in the affected nieghbourhood might or

might not suffice. Even that is working quite in the dark, for no one has the means of telling by what medium the disease is being spread without careful bacteriological examinations. (*b*) The analysis of articles sold for food, of various waters for potability, the chemical examination of substances, such as silt, sewage, deposits, and incrustations of different kinds, can, it is true, be performed by the Chemical Examiner to Government, if he has time, and if he is kind enough to undertake it, but he is unable to devote himself continually to this sort of work, and it is more satisfactory to the persons concerned to conduct the required researches themselves. (*c*) A place where the bacteriological examination of waters and the investigation of the spread of various diseases could be performed. At present there is no means in the Presidency of getting this done, as it does not fall within the province of the Chemical Examiner. The source of an outbreak of cholera can only be conjectured, the advice given when typhoid appears in a family can only be suppositional, a suspicious diarrhœa has to remain suspected till it be possible to confirm preconceived notions by the aid of a miscroscope and cultures.

ABSTRACT OF THE REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1898-99.

(*W. L. Harvey, Esq.*)

Special Drainage.—In addition to 20 unfinished works in progress three new works were commenced, viz., (1) surface drainage works in Kamathipura district; (2) 41 manholes on the old ovoid sewers in Kamathipura; (3) works in 9-inch pipe sewer in the new roads on the southern part of the Apollo Reclamation and other roads.

Pumping Station, Love Grove, Worli.—The Worthington engines at this station continued to work satisfactorily. The efficiency of the pumps ascertained by fortnightly observations showed an average of 92·4 per cent. The gunmetal rams of No. 1 engine have been replaced by cast-iron rams. This is a tentative measure for economical reasons, being much cheaper than the gunmetal rams.

House Connections.—The street portions of house drainage connections were made to 1,381 houses, at a total cost of £2,654.

WATER WORKS.—*Tansa Lake.*—The rainfall for the year 1898 was 98·68 inches, that for 1896 and 1897 being 120·13 and 104·82 inches respectively. The heaviest fall of rain occurred on the 21st July when 4·05 inches were registered. The lowest recorded level of the water was 394·53 T.H.D. on the 9th June, 1898. The lake commenced to overflow on the 8th July after 31·52 inches of rain had been registered, and ceased to overflow on the 4th October, 1898. The storage above the lowest outlet on the 1st October, 1898, was 18,600 millions of gallons, and on the 1st April, 1899, it was 12,113 millions of gallons, showing a consumption of 6,487 millions of gallons in six months, or 35·6 millions of gallons per day, including evaporation and leakage; of this about 23·8 million gallons were delivered into the aqueduct. The quantity of water which passed over the waste weir is estimated at 25·198 millions of gallons. The highest flood level was 405·9 T.H.D. on the 21st July. The balance of water delivered at Ghatcooper syphon head is estimated at 7,873·1 millions of gallons. About 47·5 millions of gallons passed into the Vehar Lake as against 165 and 213 millions for the years 1896–97 and 1897–98 respectively. The amount is yearly diminishing owing to the increasing consumption of Tansa water.

Vehar Lake.—The rainfall for 1898 was 94·51 inches, that for 1896 and 1897 being 109·81 and 97·36 respectively. The heaviest fall occurred on the 22nd July, when 6·23 inches were registered. The lowest water level during the year was 252·80 T.H.D. on the 8th June, 1898. The overflow commenced on the 11th September and ceased on the 1st October, 1898. The waste weir stop planks were raised, thereby increasing the storage capacity by about 400 million gallons. The storage of water on the 1st October, 1898, was 11,767 million gallons, and on the 1st April, 1899, 8,940 million gallons, showing a consumption of 2,827 million gallons, including evaporation and leakage, but exclusive of that received from Tansa duct. This consumption covers a period of six dry months of the year. 47·5 million gallons were received from the Tansa overflow. The quantity of water that overflowed the waste weir is estimated at 2,300 million gallons. The filter beds worked regularly during the year and were cleansed on an average of every 10 days.

Tulsi Lake.—The rainfall for the year 1898 was 111·58 inches, that for the two previous years 1896 and 1897 being 139·52 and 118·66 inches respectively. The heaviest fall of rain occurred on the 22nd July and was registered at 9·84 inches. The lowest water level reached was 438·15 T.H.D. on the 10th June, 1898. Overflow commenced on the 24th July, 1898, and ceased on the 21st September. The storage on the 1st October, 1898, was 2,269 millions of gallons, and on the 1st April, 1899, 1,222 millions of gallons, thus showing a consumption of 1,047 millions of gallons. During

the six dry months of October to March this was inclusive of evaporation and leakage. The catch-water channel entering the lake at the south-west and was repaired and other necessary work done departmentally.

Pawai Lake.—Negotiations have been concluded between the Corporation and the Agave Fibre Syndicate to let the property for the cultivation of the Agave plant and its manufacture into fibre, and to supply water from the lake.

Bhandarwada Reservoir.—On account of the contractor not washing the sand for the filters in a proper manner, this portion of the work is being done departmentally. Filter No. 9 was put in use on the 14th February, 1899, and found to work satisfactorily, but the rate of filtration is practically reduced by one-fourth owing to a leak through the arching into the reservoir. The work of charging filter No. 8 is nearly complete. The filtering materials of No. 5 filter have been washed and replaced departmentally at a cost of £131. It is now working satisfactorily.

Malabar Hill Reservoir.—The sand in filters Nos. 2 and 3, which was the subject of a dispute with the contractors, has been washed and replaced departmentally at a cost of £158, of which £30 were contributed by the contractors. The filters are now working satisfactorily. It is proposed to extend the filter-beds, but experiments will first be made to ascertain the most efficient rate of filtration.

Miscellaneous Works.—The laying of the 9-inch main in Worli Road substituted for the 3-inch main was completed during the year at a cost of £2,841, and is now in use. The work of laying 4-inch cast-iron mains in various parts of the city at an estimated cost of £1,625 was completed on the 12th May at an expenditure of £1,518. The total number of lineal feet laid was 9,098.

A revised scheme for extension of mains in various parts of the city is the subject of inquiry by a committee of the Corporation.

Distribution and Maintenance.—The number of connections cut off during the year at the instance of the Executive Health Officer was 204, and to meet the necessities of the people 151 stand pipes were erected. The consumption of water continues to be excessive and was about the same as the previous year. The number of bursts during the year was 93 against 109 the previous year. The net increase in the number of connections, exclusive of those made for health camps, &c., has been 175 or 3·7 per cent. The total number now stands at 19,990. The number of meters in use on the 31st March, 1899, was 2,371, being an increase of 162 on that for the previous year. The consumption by meter for the year registered a little over 1,470 millions of gallons. For the preceding year the quantity was a little over 1,253 millions of gallons.

PUBLIC HEALTH.—The state of the public health during the year under review was unsatisfactory. The mortality was 4,065 more than in the preceding year. The total number of deaths from all causes amounted to 51,961, equal to a death-rate of 63·23 per 1,000 of population, calculated on a population of 821,764 (census of 1891). The average number of deaths for the previous five years amounted to 156,900, or a death-rate of 38·18 per 1,000 of population.

The number of deaths according to place of birth was as follows :—

Born in Bombay	15,479
Born elsewhere and unknown	33,733

The sections of highest mortality were Kamathipura 95·91, 2nd Nagpada 95·48, Byculla 88·68, Parel 81·48, Kumbharwada 79·54, Tardeo 77·08, and the sections of the lowest mortality were Water Division 2·25, Fort Southern 4·30, and Walkeshwar 20·01 per 1,000 of population. The death-rate was highest amongst Negro-Africans, Lingayets, Low-caste Hindus, Jains, Mussalmans, and Buddhists being respectively, 616·44, 159·43, 98·82, 84·04, 72·60, 63·15 per 1,000 of population, and lowest amongst Europeans, Jews. Parsees, Eurasians, Brahmins, and Native Christians being respectively 17·89, 36·84, 39·13, 45·26, 46·70, 47·28 per 1,000 of population.

Small-pox.—The deaths from small-pox were 55, being two less than in the preceding year. The rate of mortality was highest among Native Christians. The mortality was highest in 1st Nagpada, Water Division, Mahim, Worli, Sewri, and Mazagon.

Measles.—There were 254 deaths from measles, being 105 less than in the last year. Of these, 200 occurred in the first four years of life. The highest mortality was amongst Lingayets, Hindu low-castes, Jews, and Mussalmans. The death-rate was highest in 1st Nagpada, Khara Talao, Dongri, 2nd Nagpada, Kamathipura, and Byculla.

Fevers.—There were 4,114 deaths from fevers, being 2,837 less than in the last year. The death-rate was highest in the districts of Parel, Mahim, Kumbharwada, and Byculla. The greatest mortality was amongst Negro-Africans, Hindu low-castes, Mussalmans, and Native Christians.

Cholera.—The number of deaths from cholera was 104, being 1,161 less than in the preceding year. The sections of the highest mortality were Sion, Mahim, Dongri, Mahaluxmi, and Byculla, being ·35, ·27, ·26, ·23, ·23 per 1,000 of population. The highest death-rate by caste was among Native Christians, Jains, and Hindu low-castes.

Phthisis.—There were 5,624 deaths from phthisis, being 303 less than in the previous year. The death-rate was highest in 2nd Nagpada, Umarkhadi, Chakla, Kamathipura, and Khara Talao sections. The greatest mortality was amongst Negro-Africans, Lingayets, Mussalmans, Hindu low-castes, and Jains.

Leprosy.—There were 51 deaths from leprosy, being 12 less than in the preceding year.

Plague.—There were 18,185 deaths from plague, being 7,182 more than in the last year. Detailed particulars of this disease have been given by the Executive Health Officer in his report.

Births.—The number of births registered, exclusive of still-born, was 10,784, or 1,448 more than in the last year. Of these, 5,640 were males and 5,144 females. The diminution in the number was probably due to the exodus of people on account of the prevalence of plague. Excluding Negro-Africans, the birth-rate was highest amongst Hindu low-castes, Jews, Lingayets. The sections giving the highest birth-rate were Mahim and Sewri.

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ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1898.

(*Lieutenant-Colonel T. S. Weir, I.M.S.*)

Before examining the mortality, it is well to consider the position of Bombay. The portion of Bombay on which most of the population live in closely built houses and densely populated habitations lies in a valley between rocky ridges, the centre of the valley being in places below mean sea level; on the south side most open to the sea, and raised above the sea level by sand and alluvial deposits. Up the valley, between hillocks, at one time flowed creeks. These creeks and the hollows, over which the sea water spread, have been largely filled with vegetable matters which have not yet at depths decomposed. There is still underground an ooze where these creeks flowed, and the ground waters of the valley are influenced by the pressure of the sea currents around. The valley of Bombay is most unfavourably situated. Into it flows the rain water from higher lands, the escape of which is obstructed by roadways and buildings, and to the north by a dense clay formation. But happily the soil has a marvellous power of purification, even greater than the air. In the centre of the valley towards which most of the drainage flows the soil is a stiff clay.

The area of Bombay is about 22 square miles, and on a portion of this area there is the most densely crowded population in the British Empire, the six sections of greatest density of population having 227,021 people on an area of 403·28 acres.

In 1895, before the appearance of plague, Bombay was more healthy than any large city in India, and the chances of life were better than in many European towns. It is fervently hoped that this will be the last of this abnormal cycle of years. The Meteorological Reporter was of opinion, that the remarkable period through which India has passed had terminated, in 1897, and a period of normal conditions, he now thinks, is probable for two or three years.

The temperature of the air in April, May, June, July, August, September, October, and November was above the average. It is a curious and important fact that the ground temperature since 1896 has been rising at all depths, more or less, except in the cold season, being 84·8 in 1896, 84·9 in 1897, and 86·3 in 1898—5 feet below the ground in each year. The total rainfall for 1898 was 7·44 inches less than in 1897, and 13·56 inches less than in 1896.

There were observed during the year some meteorological phenomena of interest and deserving of notice. On the morning of the 6th of July there was a strong smell, as if sulphuretted hydrogen was generated, over the north of the island, and especially from the salt channels across Matunga and the vacant ground to the north. The smell seemed strongest furthest to the north. At this time a migration of rats had been observed across Sewree, and I believe the smell was due to the decomposition of dead rats, for a number of bodies of rats were afterwards found in the suburbs. The Commissioner of Police and I happened to go over the north of the island on this morning in connection with arrangements being made for the inspection of traffic by the roadways into Bombay, and we tried to ascertain the cause. The smell was most offensive, tainting the air far and wide. A blue haze was often observed in the evenings of September and October, and rainbows which I had not observed in Bombay for a long period. At this season boils were very prevalent. On the 9th of September a gale blew, and the sky looked like a monsoon storm. In the evening rain fell. A little time afterwards dead rats were found on the west foreshore. There were few mosquitoes seen during the epidemic period of 1898, and it seemed as if they had almost disappeared from the island. The disappearance of mosquitoes was again observed in August.

The epidemic gradually rose from the middle of December, 1897 (a little later than in 1896), till on the 9th February, 1898, a mortality of 347 was recorded, followed by a series of repressions and fluctuations till the 16th of March, when the mortality rose to 358, and again on the 18th of March to the same number, from which date the epidemic began to decline, and fell until in the middle of June and up to the end of August it descended

below the mortality in the corresponding month of 1897. From the end of June the mortality began to ascend till it reached its maximum in the second week of October and then fell, but not descending again to the curve of June, and again began to ascend in the first week of December. It has to be remembered that the total mortality from all causes was not as high as the mortality from plague alone in many cities in India. In 1896 the total mortality was only 40·71 per 1,000, in 1897 it was 58·28 per 1,000, and in 1898 it is not over 63·23 per 1,000.

The hopes that some sanguine people entertained, that it was only necessary to carry out a few sanitary measures, and the disease of plague would stop, have been grievously disappointed. We see now after three years of incessant activity against plague that the disease is more virulent and destructive in type than ever. It is not that the mortality is high after what has been done, but it is what it might have been, and it has to be considered what the mortality would assuredly have been, if the measures that have been carried out had not been taken. Whatever the period or whatever the measures, whether of the Health Department or of the Plague Committee, it is marvellous that the mortality has been so low, that the measures have saved so many lives; and equally marvellous that the city has suffered so little.

Such was the general course followed by the epidemic in 1898. The view I held was that the epidemic had been prolonged by the concealment of cases, and that the type was intensified by concealment.

As soon as I returned from leave in January, 1898, I wrote a report commenting on the progress of the epidemic, the measures of the Plague Committee, and the concealment of cases, and recommending certain measures.

The difficulties of obtaining information that beset the Plague Committee were very great. The type of disease, as in former years, was often difficult of recognition. There was a type similar to cholera, and there were types of disease in cases of which it was difficult, even with a bacteriological examination, to establish whether they were plague or relapsing fever. The Plague Commission had an opportunity of seeing one of these cases on their first visit to one of our hospitals. The case was supposed to be one of pneumonic plague with petechiæ, but bacteriological examination proved it to be one of relapsing fever. Cases began with ordinary fever; afterwards fever with symptoms like those of relapsing fever supervened, and finally plague developed.

It is scarcely necessary for me to discuss the policy followed in 1898, as the policy is now practically the same as the policy followed by the Health Department when plague first appeared. The policy of 1896 has been justified by events and by the visitations of the following years.

The experience of this year indicates that the measures enforced in 1898 did not produce better results than the measures adopted in the previous years.

On the 1st of June the city plague administration was taken over by me, and one of the first measures I gave attention to was *inoculation*. Already I had been busy opening stations for inoculation, and I had been with M. Haffkine to chawls, persuading the people to be inoculated, and we had a great measure of help and encouragement. I began, after taking over charge, a system of payment to the poor at the time of inoculation, and certainly it led to a great increase in the number of inoculations. M. Haffkine one morning with me vaccinated in one chawl as many as 45 people, 22 of whom were women. It was afterwards considered necessary to discontinue payment, and the desire for inoculations began to decrease owing to other causes and influences, the most serious effect of which was, not a spirit of opposition, but a want of faith. Inoculation to be successful must be encouraged at the right time. There is a fashion, and also a sentiment, as in everything human, which have to be taken account of. Taken at the right moment, numbers of people may be persuaded to be inoculated, who could not or would not be persuaded at any other time. Besides, there is not the fear of the disease in Bombay that exists in other places where the disease has been very destructive and fatal. It is necessary to the success of inoculation (1) that the local reaction and pain should be reduced, (2) that the operation should be performed with care and therefore slowly.

I think that everything that could be done to open inoculation stations, and persuade the people to be inoculated, was done after the municipality took over charge of plague measures. About 34 stations were opened, and of the 34 inoculating officers 13 were under the municipality. After June, when the municipality took over charge of the plague administration, M. Haffkine and other officers accompanied me to the houses of the poor to inoculate people; but there was not the dread of the disease which was necessary to help us to inoculate large numbers. We met with much encouragement. Frequent meetings were held in the city, at which the Municipal Commissioner, Mr. Harvey

was present, and the Commissioner formed a Committee, over which he presided, which sat every week in his office to deliberate on the progress of inoculation and to discuss the best measures to be adopted. I do not think more could have been done than was done in 1898 to bring inoculation within reach of the people, or to persuade the people to be inoculated.

The mortality from plague by class indicates that the classes most careful of animal life, and most engaged in the distribution of the grain supply, have suffered most. The low mortality amongst Mussalman must, I think, be ascribed to imperfect recognition. The mortality amongst Hindu low castes is almost the same as in 1897. The mortality amongst three classes, *i.e.*, Europeans, Eurasians, and Parsees, rises progressively from 1·32 amongst Europeans (almost the same as in 1897) to 7·39 amongst Eurasians, being 2·3 less than in 1897, to 10·28 amongst Parsees, being 2·7 more than in 1897. It is interesting that in this year of enhanced virulence and greater intensity the number of Europeans who suffered should be five less than in 1897.

The distribution by localities of the 18,185 deaths from plague is interesting, and follows nearly the same incidence as in former years. It is difficult to draw any exact conclusions from the recorded mortality by sections from plague. There was the difficulty of recognition or detection, and there was concealment influencing the registration of the disease. One of the sections of low mortality, 12·87 per 1,000, was Khara Talao, and yet this section is one of the most insanitary and overcrowded sections in the whole island. The other sections of low mortality are a portion of the Mandvi ward, Chuckla, and Umerkhadi. The distribution of mortality indicates either imperfect recognition or concealment in some sections. There are sections where the mortality must be low, but there are sections where, if the mortality is low, it cannot be correct. It is easy to place the finger on the localities of most concealment. The ward of highest recognised plague mortality is E Ward, which is therefore probably the ward of most detection.

In both sexes a greater enhancement of mortality was observed amongst those over five years of age than at an earlier period of life. It may be said that the disease is most difficult of recognition and most easy of concealment in those under five years of age, and therefore the enhancement over five years of age is due to more exact registration. The most susceptible periods are between 25 and 40 years.

The course of the mortality by dwellings is almost the same as in 1897, and illustrates the influence of ventilation, though it is not necessary to illustrate by statistics the influence of ventilation on the occurrence of cases any more. The mortality decreased with the height of the dwelling, being nearly 86 per cent. on the ground floor, over 77 on the first floor, 71 on the second floor, 61 on the third floor, 57 on the fourth floor, and 51 on the fifth floor. In 1897 the chances of recovery progressively increased from the first floor upwards, from a mortality of 84 per cent. on the ground floor to 45 per cent. on the fifth floor. In all wards there was the same progressive decrease in the fatality with the height of buildings.

While writing of the mortality by buildings and floors, I would draw attention to the remarks I made last year in regard to the recurrence of plague in buildings. It is, I believe, chiefly due to the existence in these buildings of attractive and favourite feeding and hiding places for rats. At first I thought the greater freedom of certain dwellings or the reduced incidence of plague in some buildings after the drainage had been improved was due to the effect of the improvement of house drainage, but afterwards I came to the conclusion that it was chiefly due to the closing and filling up of rat holes. Therefore, if it were practicable to improve house drainage, to clean and renew all down-take pipes, to properly construct or repair all house gullies and drains, it would have a great influence on the recrudescence of plague. I have in previous years given statistics showing the recurrence of plague by houses, and I have given evidence on the subject before the Plague Commission.

The mortality was highest in March and lowest in June. The most rapid development and spread of the disease occurred in February, the deaths rising to 348 on one day. In February the number of cases rose to 5,351 from 3,654 in January, of whom nearly 84 per cent. died. In March there was a further rise to 5,764 cases and an increase in the mortality to 86 per cent. In April the cases fell to less than one half and the mortality declined, being equal to nearly 80 per cent. The highest mortality for any one day was 358 on the 16th of March, and again on the 18th, when it was the same number. The disease decreased a little after the middle of March, and the decline became rapid towards the end of the month, and reached its minimum by the end of June. A recrudescence began towards the end of July, and reached its maximum in October, followed by a

further recrudescence in the middle of December to develop into a greater epidemic than known before.

General Mortality by Causes.—The highest mortality from any one death cause is referred to plague, being 22·12 per 1,000 against 13·3 per 1,000 in 1897. Concurrently with the increase in the mortality from plague there was an increase in the mortality from diseases of the respiratory system, but a considerable decrease in the mortality ascribed to phthisis and fevers. The chief death causes that contributed to the high mortality are plague, diseases of the respiratory system, and phthisis.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM THE PRINCIPAL CAUSES DURING 1898.

Cause of Death.	No. of Deaths.	Death-rate per 1,000 of Population.
Small-pox	55	·06
Measles	254	·30
Fevers	4,114	5·00
Cholera	104	·12
Phthisis	5,624	6·84
Plague	18,185	22·12
Diseases of the Nervous System	2,577	3·13
Do. Respiratory System	8,423	10·24
Diarrhœa	1,800	2·19
Dysentery	1,585	1·92
Accidents	559	·68
Other and unknown causes except still-born	8,681	10·56
Total	51,961	63·23

The mortality rapidly rose in January through February until a maximum was reached in March. The highest mortality was registered in March, being 9,196 deaths. A recrudescence began in August, developing into a monthly mortality of 3,507 in October.

The incidence of the mortality by place of birth indicates even more stongly than the statistics of last year, that the chief sufferers from plague in the population are strangers. In 1897 a total of 16,191 persons born in Bombay and 30,579 born elsewhere died. In 1898 the mortality amongst strangers is even more in excess—33,733 died and only 15,479 of the people born in Bombay. The course of the epidemic is well indicated by the mortality amongst the people born outside of Bombay. Through January and February the mortality rose till it reached its maximum in March. A progressive decrease followed till July, when a further recrudescence occurred, which subsided in or about November to revive again in December.

Notwithstanding the high mortality of the year, the death-rate of Europeans was only 17·89 per 1,000, lower than in the previous and many other years. The total death-rate amongst Europeans in 1898 is lower than in any year since 1893! This is a very remarkable protection from disease during a year of plague. Yet Europeans did not flee, and many of them approached the sick and exposed themselves fearlessly in aid of the suffering. The Mussulman mortality is also lower than in 1897. The mortality amongst Jews was under 37 per 1,000 and amongst Parsees 39·13 per 1,000. The mortality amongst Parsees is 6·5 per 1,000 higher than in 1897. Excluding small communities, the highest mortality occurred amongst the mass of the Hindu population, being equal to 93 per 1,000. Mussalman, a large community, have the next highest mortality, the death-rate being as high as 72·60 per 1,000.

If the mortality of the classes is examined according to sex, it will be observed that the mortality of the communities amongst whom the death-rate was highest was influenced by a high fatality and great loss of female life. Take, for instance, the mass of the Hindu low caste population, the excess of female mortality was equal to 11 per 1,000 and amongst Mussalman as much as 22·6 per 1,000. If we take the classes of low mortality, it will be observed that the excess of female mortality is not great. Amongst Parsees it is 2·8, amongst Jews 3·5, and amongst Europeans 7·2. The plague death-rate of Europeans was only 1·32 per 1,000, the attacks being 20 and the deaths 15, out of a total population of a little more than 11,000 Europeans.

The mortality of females is 10·66 in excess of the male death-rate. The mortality amongst males was highest under one year of age, and descended till the period of life

between 15 and 19 years of age, and again rose from 20 to 24 years. The female mortality followed almost the same incidence as that of the male. But the excess female mortality is less than in the years preceding the appearance of plague. The female mortality is almost the same as in 1897, and the excess mortality of the year is amongst males.

As in 1897, the mortality in some of the most crowded sections is relatively low. It is also very remarkable that in some sections in this year a comparatively low mortality has been recorded, notwithstanding the epidemic of plague, and notwithstanding the apprehensions that have been felt. In the Fort South, the death-rate was only a little over 4 per 1,000. In a favourite locality, such as Walkeshwar, the death-rate may be expected to be low, and it will be observed that it is only just over 20 per 1,000. In the Esplanade, a locality in the distribution of its population not unlike Walkeshwar, it is only 24 per 1,000. In the suburb of Sion the mortality is only 36 per 1,000, but in the great section of Fanaswady the mortality is not higher than 48 per 1,000. In the densely populated section of the Market the mortality is under 50 per 1,000. In some of the suburbs the mortality is higher than in the most densely populated localities. This is partly due to the movement of the population from the city to the suburbs. But it is also greatly due to other reasons which have been discussed at length in previous reports.

Cholera and Famine.—Amongst the ill-fed during years of famine or scarcity the famine types of disease may be expected ; and though with a better year than in 1896 and 1897 the immigration of the destitute was less, there were a large number of people who, if not famished, were in ill-health from poor food and wretched lodging. In the last report I drew attention to the fact that, synchronous with the prevalence of cholera in this city during the monsoon, the disease was epidemic in the country around. The mortality from cholera this year is small, only 104 deaths were registered, being 1,161 less than 1897 and 380 less than the average. The mortality declined progressively in the first three months of the year, and later only three deaths were registered in June ; but in July there was a slight increase.

The sections of highest mortality were Sion, Mahim, Dongri, Mahaluxmi, and Byculla. Excepting one section, the northern suburbs were most affected. In 1897 the same incidence was observed. The distribution of mortality by class shows that the Native Christians had the largest number of cases, and following them, Hindus. The mortality by sex indicates that the disease fell heaviest on males, the male death-rate being ·15 per 1,000, and the female ·07 per 1,000, although the percentage of deaths to attacks among females is slightly higher than that of males. The mortality by place of birth is very striking ; whereas there were only nine deaths of persons whose birth-place was Bombay, there were 95 deaths of persons whose birth-places were outside Bombay.

Fevers.—From fevers 4,114 deaths were registered, being 2,837 less than last year and 2,772 less than the average. Of the deaths from fevers, 3,716 were referred to remittent fever, being 2,188 less than in 1897 and 1,957 less than the average. 259 deaths were ascribed to simple fever, being 530 less than in 1897 and 652 less than the average. To ague 102 deaths were referred, being 123 less than in 1897 and 170 less than the average. To enteric fever 37 deaths were referred, being four more than in 1897 and seven more than the average. The mortality from fevers did not follow the same incidence as in 1897. In that year the mortality from fevers decreased in the first half of the year as the epidemic of plague declined, and again increased in the rains with the revival of plague. It will be remembered that through the monsoon of 1897 there was a serious increase in the mortality from fevers concurrently with the prevalence of cholera. In 1898 the increase during the rains concurrently with the recrudescence of plague was observed later, and proved to be much lower. Taking the whole the year 1898, the fluctuations in the mortality from fevers were much lower than in 1897. The highest mortality was registered in March, and the lowest in the second month of the rains in July. The investigations of Ross on the conveyance of malarial organisms by mosquitoes suggests to us the necessity of studying the mosquito life of this island. The part played by the mosquito suggests also an explanation of the fluctuations in the district mortality.

There were, however, great fluctuations observed in the mortality from fevers in different months in some classes. In April the mortality from fevers amongst low-caste Hindus rose from 1·3 per 1 000 in March to 8·2 per 1,000 in April, and remained high till November. The mortality amongst Mussulman decreased in April and continued to decline till August. The mortality amongst Parsees reached its maximum in February

and did not rise again during the year. The mortality amongst Europeans was very low in January, and in February and March there were no deaths; but in April and May the mortality rose, to decline in June. It ascended in July and August and descended in September, to rise again in October. There were no deaths in November and December. In this year, as in 1897, the mortality amongst Brahmins is low. The mortality by class fluctuates between 1·7 amongst Europeans and 6·9 amongst Hindu low-castes. The mortality of Mussulman is lower, and the death-rate among Parsis is a little above that of Europeans.

The highest mortality from fevers occurred in Parel, Mahim, Kumbharwada, and Byculla. As in 1897, the mortality in some of the most crowded sections is less than in the suburbs. Except in one suburb, Sion, the mortality in all the suburbs is above the average. I believe the part played by the mosquito in the communication of fevers will be found to be the explanation of this incidence of fevers in localities.

A total of 546 deaths was registered from relapsing fever. There were two recrudescences of the disease during the year—one in the cold season attaining its maximum in March, and the second attaining its maximum in the rainy season in October, the maxima periods of intensity corresponding with the maxima periods of intensity of plague. In the Arthur Road Hospital 1,581 cases of relapsing fever were admitted, of whom 329, or 20·8 per cent., died. It is well to contrast this mortality with the death-rate of 73·25 from plague, which was nearly 7 per cent. higher than in 1896–97.

Measles.—From measles 254 deaths were registered, being 105 less than in 1897 and 190 less than the average. The distribution of the mortality follows nearly the same course as in former years, being highest among the Hindu low-castes of all large sections of the population. The death-rate amongst Jews comes next, followed by the mortality amongst Mussalman. As in preceding years the mortality amongst females was higher than amongst males, the death-rate amongst females being ·44 per 1,000, and males ·22 per 1,000.

Phthisis.—From phthisis 5,624 deaths were registered, being 303 less than in 1897 and 1,372 more than the average. The mortality follows the same incidence, in spite of plague, as in former years. In each year it has testified to the great loss of life caused by seclusion in crowded and ill-ventilated dwellings. The same sections in this year as in the past are sections of high mortality. The sections of ill-repute for this disease are—2nd Nagpada, Umarkhadi, Chuckla, Kamathipura, Khara Talao, and Byculla. Byculla has this year, with an increasing population, displaced Bhuleshwar. These are the sections to which the attention of the Improvement Trust has been drawn, and it has, as I know, been already given to them, and surveys have been made. What is wanted in all these sections is more ventilation of building and more ventilation of locality. There are too many houses and people. The number of houses must be reduced, and the number of rooms in the houses that are left must be fewer. The reduction of mortality, as compared with 1897, is due to a lower death-rate amongst females, the number of deaths of females being 2,940 against 3,075 in the last year. But though there is a reduction in the total female mortality, the mortality amongst females is yet very nearly double that of males. This great tax of disease falls on Mussulman and some high-class Hindus. In the mass of the poor Hindu population, in spite of the laborious lives of the women, the mortality is less than half the loss of life of Mussulman. There is a decrease of 173 in the mortality amongst Mussulman, but I think this must be chiefly ascribed to a decrease in the female population. The decrease in the mortality from phthisis indicates one of two things, *i.e.*, either that there had not been great concealment of plague, or that the phthisical population had been reduced by plague. Both amongst males and females the mortality rose after 10 years of age, as was observed in 1897. In the period between 10 and 14 the first great divergence in the mortality between males and females occurs. This is the period when women come under the conditions that most favour the communication of phthisis. At this time of life the female mortality is more than three times the male death-rate.

Small-pox.—During the year only 55 deaths were registered from small-pox against 57 in 1897. Of the deaths from this disease 36 occurred amongst the mass of the Hindu population, and 11 amongst Mussulman. As in the previous year, when the disease was not epidemic, it was most prevalent in certain sections, which are insanitary and have a large proportion of unvaccinated. The mortality at age periods was highest under five years of age.

Diseases of the Respiratory System.—From diseases of the respiratory system 8,423 deaths were registered, being 566 more than in 1897 and 2,885 more than the average. Of the deaths from diseases of the respiratory system, 4,458 were referred to bronchitis, being 372 less than in 1897 and 1,136 more than the average. To pneumonia 1,370 deaths were referred, being 38 more than in 1897 and 20 more than the average. To whooping cough 182 deaths were registered, being 99 less than in 1897.

Births.—10,784 living and 1,569 still-born births were registered, being 1,448 more than in the last year. Of the living births 5,640 were males and 5,144 were females. The proportion of males to females by the census of 1891 was as 170·60 to 100, and assuming that there were 100 females to 100 males, the birth-rate would be equal to 22·38 per 1,000 of population. The decrease in the birth-rate, which has been observed in the areas affected by plague, is a phenomenon that must be anticipated from a study of the historical events that have marked all plague epidemics. It is a phenomenon so constant in plague epidemics that, had it not been observed in Bombay, the birth registration must have been condemned as untrue. The birth-rate in Bombay, assuming that there are 100 males to 100 females, was equal to 32·55 in 1895 to 32·97 in 1896, to 19·38 in 1897 and 22·38 in 1898. Had the birth-rate been of nearly nominal rate in 1897 and 1898 it would have been due either to incorrect registration or to an extraordinary immigration of women.

APPENDIX.

No. 1.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner with the Government of India for 1898.

The weather during 1898, according to the meteorological summary given in the first section of the Report, was quieter and more settled than usual throughout the whole year, and in most months was drier than the average. From March to May was unusually hot and dry in most parts of the country, and the mean humidity for the whole of India for the year was slightly below normal. The mean cloud amount of the year was 0·2 below normal: all periods of the year, except the monsoon period, had less cloud than the average. The rainfall of the whole year for the whole of India showed a variation from the normal of 0·43 inch in excess, as compared with variations in defect of the normal of 0·15 inch in the previous year, of 4·83 inches in 1896, and of 2·19 inches in 1895. In the cold weather period the rainfall was abnormal in its occurrence and distribution, scanty and in defect in January, and general and widespread in February. For the whole cold weather period the total was generally in excess. March, April, and May were all abnormally dry months over India, but in parts of Burma the rainfall during this period was above the normal. The monsoon commenced slightly later than usual along the West Coast, but the humid currents extended rapidly into the interior. The Bombay current was weak in August, and the rainfall scanty, but in September and October conditions were fairly normal. The rainfall of the last period of the year, November and December, was slight and scanty, except in Madras, where it was generally excessive. To what extent the public health was affected by the weather conditions, thus slightly sketched, it might not be easy to say; but the records of vital statistics show that the year was characterised by lessened mortality from malarial fevers and bowel complaints, and by a marked decrease of epidemic cholera and small-pox.

2. The average strength of the *European Army of India* was 67,741, or slightly less than that of the previous year. As measured by the ratios of admissions into hospital, constantly sick, and deaths, the health of the Army was better than in the previous year; but the ratio of invaliding was higher, and the total loss from deaths and invaliding combined was greater than in the previous year. Compared with those of the decennium 1886–95, the results are in all particulars, except in respect of admissions into hospital, unfavourable to the year under review; the constantly sick increased from a ratio, per 1,000 of strength, of 83 to 90, the deaths from a ratio of 15·16 to 20·05, and the invaliding from a ratio of 24 to 38; whilst the total loss, from deaths and invaliding combined, increased from a ratio of 39 to 58. The chief causes of admission into hospital were, again, ague and venereal disease; the former accounting for a ratio of 394·0, and the latter for a ratio of 362·9 admissions, per 1,000 of strength. The ratio of admissions from ague was nearly the same as in the previous year, but that from venereal disease decreased by 124·8 per 1,000 of strength. From ague and venereal disease combined, the ratio of admissions decreased from 882·4 in the previous year to 756·9 in the year under report, but still formed considerably more than half the total ratio from all causes. Ague, of itself, caused 27 per cent., and venereal disease 25 per cent. of the total admissions from all causes.

3. The diseases responsible for the greater proportion of the admissions took but a small share in causing the mortality for the year. Ague is credited with a death-rate of only ·30 per 1,000 of strength; and Table I. records no death as directly due to venereal disease. On the other hand, enteric fever, against which is recorded an admission rate of only 36·9, caused a death-rate of 10·17, or more than half the total death-rate of 20·05 for the year. Next to enteric fever, as causes of mortality, came abscess of the liver with a death-rate of 1·52, and heat-stroke with a death-rate of 1·17. The combined mortality from these three causes—enteric fever, abscess of the liver, and heat-stroke—was equal to 65 per cent. of the total mortality for the year. From no other one disease did the ratio of mortality reach 1 per 1,000 of strength—dysentery with a ratio of ·78, and pneumonia with a ratio of ·61, having been the next most fatal.

4. But, although the diseases chiefly concerned in causing admissions into hospital take a very subordinate place as causes of mortality, they again resume their foremost place in the list of causes of invaliding. Of a total number of 2,580 men invalided during the year, ague was accountable for 464, and syphilis and gonorrhœa for 569. The other chief causes of invaliding were affections of the circulatory system, debility, dysentery, and tubercle of the lungs. During the previous year the number of men invalided on account of secondary syphilis was 611, and during the year under review 547.

5. Of the four *Commands*, that of Madras was again the healthiest, as measured by the ratios of admissions and of deaths; whilst the Punjab Command, judged in the same way, was the most unhealthy. The ratio of admissions into hospital, per 1,000 of strength, in the Madras Command was 1292·6 as compared with 1558·0 in the Punjab; whilst the death-rate in the Madras Command was only 8·59, or less than a third of that recorded for the Punjab Command. Of the other two

Commands, the ratios of admissions and deaths in Bengal approached the closest to those of the Punjab; and the ratios in Bombay the closest to those of Madras. The Punjab was the only Command less healthy than in the previous year. In this last Command were recorded the highest ratios of deaths from cholera, enteric fever, malarial fevers, heat-stroke, pneumonia, and other respiratory diseases, and dysentery. Exposure, and the subsequent effects of exposure, to the contingencies of field service doubtless contributed to raise the admission and mortality ratios amongst the troops in the Punjab Command. The Tirah Field Force, which was broken up on the 9th of April, and out of which was formed the Khyber Force, "suffered heavily from enteric fever," as did likewise the Malakhand Force. Cholera was everywhere in comparative abeyance, only 14 deaths having been caused by it during the year. The outbreak of the disease at Umballa was the most severe, resulting in 10 of the total of 14 deaths. Pneumonia, as usual, was more fatal in the Punjab than in any of the other Commands. In none of the latter did the mortality-rate from this disease reach half of that recorded in the Punjab; in Bengal it was the lowest of all, reaching to less than a fifth of that in the Punjab Command.

6. According to *Geographical Groups*, the Gangetic Plain recorded the highest constantly-sick rate, and the Hills group the lowest; whilst the Indus Valley recorded the highest admission and highest death-rates. The Western Coast group, as usual, records low rates of sickness and mortality; but of all the groups those of Burma give the lowest death-rates for the year. The percentage of enteric fever to total admissions was greatest in hill stations, and this was also the case with regard to pneumonia and diarrhœa. In half of the other geographical groups the death-rate, from all causes combined, was less than the death-rate in hill stations from enteric fever alone.

7. The *stations*, with garrisons of upwards of 1,000 of strength, which returned the highest death-ratios were Peshawar and Quetta, the former recording a ratio of 48·95, and the latter of 44·43. Next to these two, but at a long interval, follows Lucknow with a death-ratio of 30·66. In all of these three stations enteric fever caused the largest proportion of the total death-rate. In Quetta the enteric death-rate was no less than 35·08 per 1,000 of the strength of the garrison, in Peshawar 24·48, and in Lucknow 22·57. The mortality rates in these three large garrisons in Upper India contrast strikingly with the rates recorded in three stations, with garrisons of about equal strength, in the Deccan and Southern India. In Secunderabad the total death-rate from all causes was 10·82, in Bangalore 10·64, and in Poona 9·45. It should be noted, however, that the health statistics in several of the stations in Northern India, including Peshawar, Rawalpindi, and Umballa, "are said by the medical officers to have been unfavourably "affected by the return or reception of broken-down men from frontier field service."

8. Beginning with the health statistics of the European Army of India, as a whole, the Report deals with them successively according to Commands, geographical groups, stations, and, finally, regiments. Of these last, the infantry had, as in the three preceding years, the highest admission and constantly-sick rates; whilst the cavalry had the highest death and invaliding rates. The regiment which recorded the highest death-rate was the 2nd Battalion of the Yorkshire Regiment at Peshawar. This regiment lost by deaths a ratio of 64·38 of its strength. Enteric fever was accountable for no less than 52·9 of this high ratio.

9. *Principal Diseases.*—There was a recrudescence of *influenza* during the year. The number of attacks was more than double the number in the preceding year, but fell short of that recorded in 1896. The season of greatest prevalence included, as usual, the months of March and April. Although only a single death was attributed to the disease, yet, in India, as in England, the prevalence of influenza affected, in a marked degree, the mortality ascribed to pneumonia and other respiratory diseases.

10. The European Army of India shared in the comparative immunity from *cholera* which characterised the year in India generally. Only 17 admissions, with 14 deaths, were recorded as due to this disease. The only station in which it prevailed in epidemic form was Umballa. In that station 11 Europeans were attacked, and only one of them recovered. It is worthy of remark that, of the 259 attendants on the 106 cases of cholera among Europeans and Native troops and among prisoners, not one contracted the disease. In connection with the Umballa outbreak, the only sanitary defect noted as likely to have been connected with the occurrence of cholera, was the liability of the water supply to contamination. If contamination of the water actually did take place, and was the cause of the outbreak of cholera, the question naturally comes to be asked why, out of a garrison of 1,896 men, presumably using the water-supply, all except 11 escaped attack. The movement of European troops in the seven instances in which this was resorted to was successful. "No attack occurred after movement, the effect of which on the general health was satisfactory."

11. Of *small-pox* mortality there was an entire absence; there were only two cases of the disease, with no death, against 24 cases, with four deaths, in the previous year, and against 122 cases, with 10 deaths, in 1896.

12. The ratio of admissions due to *ague* and *simple continued fever* was much the same as in the previous year. The admission-rate due to *remittent fever* in the year under report was 33 per 1,000 of strength, as compared with 25 in the preceding year, and with an average of 9 in the decennium 1886–95. The ratio of deaths from intermittent and remittent fevers was, however, lower in 1898 than in the previous year, although somewhat higher as regards simple continued fever. As in previous years, some of the medical officers differ as to where the line should be drawn between simple continued fever, ague, remittent fever, and enteric fever. "In the Cherat, Madras, Bellary, and Mandalay reports it is noticed that the relative numbers of cases of simple continued fever, ague, remittent fever, and, it might have been added, enteric fever, vary with a change of medical officer; and the medical officer of Bellary illustrates this by indicating his opinion that simple continued fever is no doubt of malarial origin."

13. The subject of *enteric fever* is dealt with at great length in the Sanitary Commissioner's Report. Of the 58 pages of Section II. devoted to a history of the health of the European Army of India, all except 19 are taken up with an account of the latest views held on the question of the etiology of the disease, followed by a description, shortened from the reports of medical officers, of some of the outbreaks among the troops during the year. The importance of the question of the causation and prevention of this most fatal of all the diseases to which the European Army of India is liable, might justify the devotion of even greater space to its consideration and discussion; but, unfortunately, neither recent research, nor the careful observations of the medical officers whose opinions are recorded in the report, seem to add much to what is already known regarding its origin and mode of spread. If results may be taken as any measure of the progress being made in knowledge of the disease, the record of another year's mortality is not encouraging. Enteric fever caused 445 deaths in the European Army of India in 1896; in the following year the number rose to 556; and now, in the year under report, it is 654. In each of these three years the death-ratios have been, successively, from 1896 onwards, 6·31, 9·01, and 10·17, per 1,000 of strength. A perusal of the account given in the report of the various theories and opinions held regarding enteric fever, is apt to produce a sense of bewilderment and uncertainty. Formerly, there was always the "solely water-borne" causation theory to fall back upon; but this exclusive view is now considered by a growing number of observers to be no longer tenable. One medical officer writes:—"It is to be hoped that the time is at hand when sanitary authorities will give their attention to some fresh point of the enteric problem, and leave the unfortunate water in peace for a time." It is acknowledged to be a common experience that enteric fever not infrequently prevails among troops using a water-supply pronounced by scientific experts to be pure and free, as far as they can ascertain, from the enteric *bacillus*; whilst, on the other hand, troops using water in which the *bacillus* is detected, often escape attack. There is already no want of suggested, or suspected, sources of infection to supplement, or take the place of, the part which water alone has hitherto been believed by many to play in the causation of enteric fever. At Quetta, the disease prevailed with greater virulence in the year under report than in any other station in India. There, "the catchment area is an ideal one, and the water above suspicion." As the result of his investigations in the cause of the fatal outbreak at that station, Major Davies, R.A.M.C., writes:—"If this reasoning be admitted, there can be no hesitation in believing that the epidemic prevalence of enteric fever at Quetta has been to a great extent of aërial origin, due to the situation of the trenches (for night-soil) to windward, and the omission to cultivate the ground." Among other possible means by which the disease may be communicated, are mentioned sick-room infection, flies, and inhalation of sewer air—the last of these suggesting revival of an old opinion. Native servants are considered by some medical officers to be media of infection; but seeing that natives are themselves immune from enteric fever, it is not very clear how they communicate the disease to others. Even the *bacillus* of *Eberth* seems of late to be in danger of being deposed from the place hitherto assigned to it of being the *causa causaus* of enteric fever. The differentiation of this *bacillus* from the *bacillus coli*—the latter an inhabitant, under ordinary conditions, of the intestine—is not always a simple matter. One medical officer writes:—"I am inclined to believe that what is known as enteric fever in India can be caused by the *bacillus coli*." Hankin's theory of "attenuated microbes" might afford some explanation of those cases in which the typhoid microbes are introduced into the body without producing infection. He says:—"My finding typhoid microbes in a water-supply gives no proof that the microbes were there present in a condition in which they could produce infection." But, tempting although the subject is, it cannot be followed further without laying this memorandum open to the charge of undue length, which we are sometimes inclined to prefer against the reports we have to deal with. Enough has perhaps been said to indicate the condition of uncertainty in which our knowledge, for practical purposes, of the cause of this terribly fatal scourge of Europeans in India still remains. Possibly, when the medical history of the war now being waged in South Africa comes to be written, some additional light may be thrown on problems connected with the origin and spread of enteric fever which are at present obscure.

14. The history of *plague* during 1898 seems to show that, unless European troops are placed under conditions which oblige them to expose themselves to the risk of infection, the chances of their contracting the disease are few. Only nine cases of the disease are recorded amongst them during the year, and of this number only two were fatal. Of the nine men attacked, all except three had been employed on plague duty. One of those attacked had been inoculated against plague in April of the previous year, and contracted the disease in the following January. The medical officer at Bangalore, where two of the cases occurred, writes:—"Inoculation and re-inoculation were performed in the case of the native followers of all British corps. To my mind this step appears to have had little practical effect, as the cases continued to be reported as regularly, and at about the same rate after inoculation as before. The step that really seems to have had most effect was the evacuation of the lines occupied by the followers of the various corps."

15. *Tubercle of the lungs* caused 37 deaths. "Much of the tubercle of the European troops is no doubt contracted in England." The ratios from all forms of tubercle disease taken together were highest in prisoners and next in European women; and these same had the highest and the next highest ratios from tubercle of the lungs. In these facts may, perhaps, be found support for the opinion now obtaining that an open air life is that most conducive to the prevention and cure of consumption. At any rate, there can be little doubt that, of the communities between which comparison of relative liability to the disease is here made, prisoners and European women in India generally pass less of their time in the open air than do the men of the European and Native armies. In an Appendix to Section X. of the Sanitary Commissioner's Report is given a "Report on the recent Congress on Tuberculosis at Berlin, with special reference to the Prevalence and Prevention of the Disease in India; by Alexander Crombie, M.D., Delegate for India." This extremely interesting and instructive report will repay perusal.

16. The sickness and mortality from *pneumonia* in the European army of India remain remarkably constant from year to year. There were 38 deaths attributed to this cause, giving a ratio practically the same as that recorded in each of the two previous years. The Indus Valley was, as usual, the geographical group in which pneumonia was most prevalent.

17. *Abscess of the liver* was responsible for 102 deaths, giving a ratio, per 1,000 of strength, of 1·52 as compared with a ratio of 1·29 in the previous year, and of 1·13 the average during the period 1886–95. A table is given showing that the mortality from abscess of the liver was 25 times greater among European than among Native soldiers. Among the 102 fatal cases, 48 were associated with dysentery or ulceration of the intestine. Of *dysentery* and *diarrhœa* there was a marked decrease in the number of admissions and in the number of deaths; these, as stated in the report, having in fact fallen to normal after the unusual elevation of the preceding year.

18. The admission-rate from *venereal disease* was 362·9 per 1,000 of strength, against 485 in the previous year, and 511·6 in 1896. As the Sanitary Commissioner puts it, there were in 1898 for every 1,000 men, nearly 123 fewer admissions to hospital for venereal disease than in 1897. But the remark that immediately follows shows this decrease to have been "partly unreal, and due to the widespread adoption of the system of treating venereally-affected men as out-patients." On the other hand the decrease was "partly real, and due to continuous and more prolonged treatment of the sick, to measures adopted under the new cantonment rules, to the placing of certain bazaars and cities out of bounds on account of the plague, and to the employment of a certain number of men on field service." When, however, it is recorded that the number of deaths directly due to venereal disease fell from 23 in the preceding year to 17 in the year under report, and the number of invalidings from 662 to 569, it cannot be denied that, whatever of *unreal* decrease the figures may conceal, there was also a decided and welcome balance of *real* decrease. The Madras Command had the lowest ratio of sickness due to venereal disease, and the Bengal Command, as usual, the highest.

19. The health of the *Native army*, with an average strength of 126,036, was, like that of the European army, better than in the previous year. The admission rate fell from a ratio of 839 per 1,000 of strength in 1897, and from an average of 976 in the decennium 1886–95, to 816 in the year under report, and was, as usual, much below the admission-rate recorded for the European army; this latter, as stated elsewhere, was 1,437. The constantly-sick rate in the Native army showed no decrease, but, on the contrary, rose from 31 to 33 per 1,000 of strength: it was still, however, greatly below the rate for European troops, which was 91. The death-rate from all causes, including the deaths of men absent from their corps, decreased from 14·90 to 13·33, and was 6·72 below the European army death-rate. As heretofore, ague was the chief cause of admission into hospital, and pneumonia the chief cause of mortality. Ague was, of itself, the cause of 41 per cent. of the total number of admissions, or of exactly the same percentage as in the previous year. Pneumonia was more fatal than in 1897, the death-rate caused by it rising from 2·73 in that year to 3·77 in the year under report: it thus caused no less than 34 per cent. of the total deaths. In agreement with the general condition of abeyance in which it remained throughout India during the year, cholera was also less fatal in the Native army—the death-rate from this cause falling from ·52 in 1897, and from a decennial average of 1·32, to ·33 in the year under report. Remittent fever caused 10 per cent. of the total number of deaths. Between them, pneumonia and remittent fever were responsible for 44 per cent. of the total mortality in the Native army. The loss from invaliding offers a strong contrast with that recorded for the European army. In the latter, 2,580 were invalided: in the Native army, of nearly double the strength, the number was 1,772. In the Native, as in the European army, intermittent fever and anæmia and debility caused a large proportion of the invaliding. In the former, 563 of the total invalidings were due to these causes, and in the latter 646. But whilst in the European army the invalidings due to venereal disease numbered 547, in the Native army they numbered from the same cause only 99.

20. According to *Geographical groups*, the Native troops stationed in the North-West Frontier and Indus Valley group give the highest ratio of admissions into hospital, and those stationed in Southern India the lowest—the former of these two groups with an admission ratio of 1119·0 per 1,000 of strength, and the latter with an admission ratio of 635·4. But Assam returns by far the highest death-rate, whilst the Gangetic Plain group gives the lowest; in the former a death-rate of 27·15 is recorded, and in the latter, one of 4·98. The Native troops in Assam suffered very severely from cholera, a ratio of 8·40 deaths from this cause alone having been recorded, and of 3·88 from dysentery. The Upper Sub-Hymalaya, Hill Stations, and North-Western Frontier and Indus Valley groups had the highest death-rates from pneumonia—each of them returning, in the order above mentioned, rates of 4·55, of 5·39, and of 9·04 per 1,000 of strength. Certain of the large stations record very high death-rates among Native troops. In Edwardesabad the death-rate for the year was 40·61, and in Datta Khel 40 32. The principal cause of death at both places was pneumonia, the former station recording a death-rate from this single disease of 29·89, and the latter of 31·36.

21. The upper of the two tables on page 87 of the Report well shows the uniformity with which each year of high *influenza* prevalence in the Native army is followed by a year of diminished prevalence of that disease; and also that, on the whole, since the great epidemic of 1890, there seems to be a tendency of both the maximum and minimum number of admissions to diminish during the years of increased and diminished prevalence which follow each other with more or less of regularity. The second table on the same page of the Report shows that "in 1898 the Native troops, with exactly the same admission-rate as the European troops, were, as usual, much less severely affected than the prisoners." The disease in the Native army was mostly of a mild type, only four deaths having been returned as directly due to it.

22. *Cholera*, *small-pox*, *ague*, and *intermittent fever* were all, excepting the last, less prevalent than in the preceding year. The greatest number of deaths from cholera occurred in Southern India and Assam, at Trichinopoly and Manipur. Of small-pox there were 26 cases with 1 death, against 53 cases and 6 deaths in 1897. The admission-rate from ague decreased from 347 to 335 per 1,000 of

strength. On the other hand, both the admission and the death rates from remittent fever rose—the former from 15·9 during the previous year to 20 in the year under report; and the latter from 1·04 to 1·08.

23. The remarkable contrast hitherto noted between the two armies, as regards their relative liability to *enteric fever*, repeats itself in the record of the year under review. Whilst in the European army the admission-rate was 36·9 of strength and the death-rate 10·17, in the Native army the former was only ·3 and the latter ·13. In the whole Native army of India 40 cases with 17 deaths were returned as enteric fever, against 51 cases with 15 deaths in 1897. But when it is added that "in not a single case does a *post-mortem* seem to have been obtained," there may be room for doubt as to whether all of the deaths were due to genuine enteric fever. That exact diagnosis is no easy matter in some cases may be concluded from the following remark:—"Two medical officers fear that, owing to the difficulty of diagnosis, they did not return all the cases that occurred in their regiments, having classed them as remittent fever, &c." The Sanitary Commissioner truly observes that, for the opinion that natives of India are apparently exempt from enteric fever only because they have already passed through the disease in infancy, has not yet been advanced the evidence of observed facts. On this question we have shown, in another *memorandum*, that such statistics as are available, and can be relied on, lend no support to the theory that natives are rendered immune from attacks of enteric fever owing to their having suffered from the disease during their childhood. The cause of the practical immunity of natives remains as yet to be discovered.

24. *Plague* caused fewer admissions and deaths during the year under review than during the previous year. In 1897 there were in the Native army 131 attacks with 82 deaths, whilst in the year under report there were only 94 attacks with 58 deaths. "Again, the chief point brought out is the benefit derived from quitting the infected lines and living in the open." Several medical officers express their belief in the protective effect of Haffkine's anti-plague serum. One of them writes: "From the facts given above regarding the mortality in relation to inoculation, there appears to be no doubt that the chances of recovery are much better in persons inoculated with Haffkine's prophylactic serum, and that such persons are less liable to be attacked."

25. *Respiratory diseases* are the chief cause of death in the Native army, and in 1898 no less than 38 per cent. of all the deaths were due to them. By far the most fatal of these diseases was pneumonia, which accounted for a ratio of 3·77 out of a total ratio of 4·13 deaths from respiratory diseases of all kinds. The admission-rate was highest, as usual, in the Indus Valley, and the death-rate was highest there also. The disease was most prevalent in the cold months of the year. The Medical Officer of the 19th Panjab Infantry thinks there is no doubt that the majority of cases of pneumonia are due to carelessness in the matter of clothing. "Even when sufficient warm clothing is supplied to the Native soldier, he constantly exposes himself needlessly, in spite of orders to the contrary." The greater liability of the Native soldier to pneumonia, as compared with his European *confrère*, is seen from a comparison of the records of admissions and deaths in the two armies. In the European army of India the ratio of admissions from pneumonia was 3·3 and of deaths ·61; in the Native army the ratio of admissions was 16 and of deaths 3·77 per 1,000 of strength.

26. From *dysentery* the admission-rate was much, and the death-rate considerably, less than in the preceding year. Whilst in the European army the admission-rate recorded from this disease was 29·8 and the death-rate ·78, in the Native army the former was 44·0 and the latter ·49. The cases were thus more numerous among the Native troops, but more severe among the European. The admission-ratios were much higher among Native troops in the hills than among European troops in the hills.

27. The prevalence of *venereal disease* in the Native army remains fairly constant from year to year. During 1898 the ratio of admissions was 40·0 per 1,000 of strength, as compared with 40·8 during the previous year. There were 8 deaths and 99 invalidings *directly* due to venereal disease. As usual, the Gurkhas suffered proportionately more than the other Native troops.

28. Under the influence of a return of more prosperous times, the *jail* population, which had increased to an average in the previous year of 118,107, fell during the year under report to 111,344. In the provinces which suffered most from famine in 1897, this decrease of itself, by reducing overcrowding in some of the jails, no doubt exercised a beneficial influence on the health of the prisoners. Moreover, the free population, having recovered from the debilitating effects of the previous famine, the health of the prisoners drawn from this population was doubtless better at the time of their reception into jail than the health of those received in the previous famine year. The sickness and mortality from almost all the diseases show a marked decrease. The prisoners shared in the immunity from *cholera*, which was so marked a feature of 1898 throughout India. The mortality from that disease decreased from a ratio of 3·94 in the previous year to a ratio of ·13 in the year under report. The decrease of mortality from *remittent fever* was slight; but the ratio of deaths from *dysentery* was only 5·72, as compared with a ratio of 11·07 in 1897. The death-rate from *diarrhœa* at the same time fell from 3·17 to 1·48. *Respiratory diseases* were only slightly less fatal; and *phthisis pulmonalis* was somewhat more fatal than in the previous year. *Dysentery*, usually the most fatal of jail diseases, caused 22 per cent. of the total deaths, *pneumonia* 15 per cent., and *tubercle of the lungs* 13 per cent., or, between them, half the total mortality for the year. As the Sanitary Commissioner with the Government of India remarks:—"There would be little exaggeration in saying that the prevention of bowel-complaints is the beginning and end of jail hygiene; as it certainly is the most difficult of the problems the jail medical officer has to face." Undoubtedly, malaria is one of the most important of the predisposing causes of dysentery, but unsuitable or ill-cooked food, as the Sanitary Commissioner observes, "is not only a predisposing but an exciting one." The Inspector-General of Prisons, North-Western Provinces, maintains that jail dysentery is infectious, and does not think that enough attention has been paid to the isolation of prisoners suffering from the disease. The same officer says pneumonia is always a fatal disease in jails, and, next to dysentery, gives most anxiety to medical

officers of jails. He thinks the prevalence of pneumonia and other respiratory diseases, and the high death-rates from these affections, have of recent years been a great deal due to the influenza epidemics which now occur almost yearly in the jails. Of *enteric fever* only 20 admissions with 9 deaths in a strength of over 111,000 were recorded during the year among the prisoners. None of the reports, it is stated, throw any light upon the origin of the cases. Of the 30 cases of *plague* which occurred in jails during the year, 29 took place in jails of the Bombay administration, and of these 30 cases 16 proved fatal. It is added that there were, besides, 10 cases with 4 deaths in the subordinate jails of Bombay.

29. The section of the report on the jails of India concludes with an interesting comparison of the mortality of prisoners with that of soldiers during the year. Taking the death-rate of European troops as 1, the death-rate of Native troops will be represented by ·6, and the death-rate of prisoners by 1·3. As already noted, bowel complaints, respiratory diseases, and tubercle of the lungs are the predominant causes of mortality in jails. The first of these, although malaria may act as a predisposing cause, are much influenced by the quality of food and water provided for the prisoners; whilst the last two are affected by the efficiency or deficiency of the ventilation of the prisoners' quarters, by the suitable or unsuitable description of clothing supplied to them, and by the nature of their occupation whilst undergoing their terms of imprisonment. The Inspector-General of Jails, North-Western Provinces, asserts that "the causes of the prevalence of tubercle are undoubtedly the sedentary occupations which have to be followed by a large proportion of the prisoners, and the inhalation of irritating particles of wool, cotton, &c., which must exist in the air of all factories." The mortality from bowel complaints recorded in the armies of India, as compared with that recorded in jails, may be represented by taking the mortality of Native troops as 1, when that of the European troops will be represented by 1·2, and that of the prisoners by 10·4. Similarly, by taking the liability to die of respiratory diseases among European troops as 1, that among Native troops is 5·4, and that among prisoners 6·4. The Sanitary Commissioner sums up the comparison in the following sentence :— "The chief cause of deaths among European troops was fevers, among Native troops respiratory diseases, and among prisoners bowel complaints."

30. The remaining sections of the Report, including those on the vital statistics, and chief diseases of the general population, vaccination and sanitary works, have already been dealt with in our *memoranda* on the provincial reports, and need not, therefore, be further noticed here. Last year we took occasion to remark on the tendency of the Annual Report of the Sanitary Commissioner with the Government of India to recover the enormous dimensions to which it had attained prior to the year 1895. Last year the Report with its Appendices covered 492 pages, as compared with 374 pages in 1895. The Report for the year under review has still further increased to 505 pages, and is again within 23 pages of being as large as it was in the year prior to its reduction in 1895. But it must be confessed that it would not be easy to select for curtailment any part of a report so ably and carefully prepared from beginning to end.

31. *Summary.*—The year 1898 was quiet, settled, and dry ; the monsoon set in somewhat late, but quickly extended over the country and gave rain in excess of the normal, or only slightly below it, to the greater part of India. The health of the European and Native armies of India was better than in the preceding year ; and the return of more prosperous times, in succession to a period of widespread scarcity, had restored the health of the general population. The sickness and mortality in the European army were less than in 1897 ; but the proportion of men invalided increased. The records of sickness, mortality, and invaliding for the year under review compare unfavourably, however, with the averages for the decennium 1886–95. As usual, ague and venereal disease were the chief causes of admission to hospital ; whilst enteric fever was, of all the diseases, by far the most destructive of life. The two diseases which were the chief causes of admissions were also the chief causes of invaliding. Of the four army commands, Madras was again the healthiest, as judged by its ratios of admissions and deaths ; whilst, judged in the same way, the Punjab command was the most unhealthy. The stations with garrisons of upwards of 1,000 which recorded the highest death rates were Peshawar and Quetta ; and those which recorded the lowest death-rate Poona, Bangalore, and Secunderabad. There was a recrudescence of influenza, and this seems to have been accompanied by increase in the admission and death rates from respiratory diseases. The European army shared in the immunity from cholera, which characterised the year generally throughout the Indian Empire. Enteric fever continued its destructive progress. The account given in the Report of the theories and opinions entertained by those who have made the disease the special subject of study and research, leads to the conclusion that many of most important problems connected with the origin and spread of the disease are still unsolved. The "solely water-borne" theory of the causation of enteric fever is being relinquished by many ; and the belief is gaining ground that the sources of infection are more varied and numerous than had hitherto generally been admitted. Of plague there were nine cases recorded in the European army, with two deaths ; six of the nine men attacked had been employed on plague duty. Tubercle of the lungs and pneumonia caused, between them, 75 deaths. Abscess of the liver was responsible for 102 deaths, and was 25 times more fatal among European than among Native soldiers. Bowel complaints were less prevalent and fatal than in 1897. There was a decided decrease in the ratio of admissions from venereal disease ; but this reduction in the admission-rate was not entirely due to less prevalence of the disease, many of the sick having been treated as out-patients at some stations. The Native, like the European, army was healthier than in the preceding year. As usual, the admission, constantly sick, and death-rates were much below those amongst the European troops. Ague was the chief cause of admissions, and pneumonia the most fatal of the diseases. As in the case of the European army, cholera, except in Assam and parts of Madras, was much less prevalent than usual in the Native army. Venereal disease varies little from year to year in the Native army ; in the year under review the admission-rate was 40·0 per 1,000 of strength, as compared with 362·9 in the European army ; and whilst enteric fever caused more than half the total number of deaths among European troops, it was credited with a total of only 17 deaths in the Native army. Respiratory diseases were the chief cause of deaths among the

Native troops, and accounted for 38 per cent. of the total deaths from all causes. Under the influence of the return of more prosperous times the jail population decreased, and the health of the prisoners improved. As in the European and Native armies, cholera was less fatal among the prisoners during 1898. Dysentery, pneumonia, and tubercle of the lungs together accounted for half the number of deaths from all causes in the jails. Briefly, "the chief cause of deaths among European troops was fever, among Native troops respiratory diseases, and among prisoners bowel complaints."

30*th June*, 1900.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1898.

The report commences with a useful account of the chief meteorological features of the year. The rainfall for the Province as a whole was in excess both of that of the preceding year and of the normal mean. The September and October rainfall, on which the failure or success of the winter rice crop so largely depends, was generally copious. The high mean temperature which prevailed in 1897 continued up to May of the year under review, except during the months of January and March. "With the setting-in of the rains this condition disappeared." In paragraph 24 is given a list of the prices of food grains for comparison with the prices for the previous year and with the average. From this table it is seen that the high prices of 1897 fell in the year under report to, or below, the average. "Reading these figures with the birth and death statistics," writes the Sanitary Commissioner, "it will be observed that the high prices ruling during 1897 greatly devitalized the people and thereby lessened their fecundity, as evidenced in the reduced birth-rate of many districts during 1898, whilst the distinct fall in prices during the year under review, due chiefly to plentiful agricultural outturn of the previous season, materially contributed to the general healthiness of the year, the people, who were well fed and well nourished, being better able to resist disease."

2. The *birth* and *death rates* are calculated on a population of 71,069,617. Enormous as this number is, it does not include the population of the entire Province. Vital statistics are not yet registered in the Chittagong Hill Tracts nor in the district of Angul. The births registered during the year somewhat exceeded two and a half millions, giving a ratio of 35·79 per thousand of population. This shows some falling-off as compared with the ratio for the previous year, when it was 36·94. The Lieutenant-Governor is not altogether disposed to agree with Major Dyson's opinion that the reduced birth-rate was chiefly due to the effect of the late famine, and, whilst admitting that the famine did without doubt exercise a certain influence in this respect, thinks the view of the Sanitary Commissioner must be accepted with modifications. It is pointed out in the Government review of the report that the North-Western Provinces and the Central Provinces suffered from famine and high prices simultaneously with Bengal, but that, unlike Bengal, both show, not a decrease, but an increase in their birth-rates. If, however, an examination is made of the birth-rates in the North-Western Provinces month by month, it will be seen that, as in Bengal, the first six months of the year show a decreased birth-rate as compared with the rate for the corresponding six months of the previous year, but that this is more than compensated for by the great increase in the last five months over the numbers in the corresponding months of 1897. In fact, the record of births during the year is similar in Bengal and the North-Western Provinces. In both Provinces, simultaneously subjected over wide extents of their areas to famine and high prices in 1897, the birth-rates were unusually low during the first seven months and unusually high during the last five months of 1898; the difference between Bengal and the North-Western Provinces being that, in the latter, the increase was so much more decided during the last five months that it not only made up for the deficit during the previous months but left the year with a surplus as compared with its predecessor. The birth-rate of 35·79 recorded in Bengal for the year is exceeded only by the rates recorded in the Punjab and North-Western Provinces. Although this is still a considerable way behind the estimated rate of 50 *per mille* of population for the Province, it shows that registration has made rapid progress since 1892, prior to which the records of vital statistics were so defective as to be perhaps as likely to mislead the sanitary inquirer as to guide him to safe conclusions.

3. The *death-rate* fell from 32·94, recorded in the previous year, to 26·57 per thousand of population, and was 2·20 below the rate recorded for the ten-year period 1888–97. The decrease was due to less prevalence of all the chief diseases, but more especially of fever and cholera. As usual, cholera and bowel complaints were more fatal in towns than in rural areas. This is due in the main, the Sanitary Commissioner thinks, to overcrowding in towns, with its attendant evils. Possibly, as we have elsewhere remarked, the differentiation of the causes of death is somewhat more intelligently effected in towns than in rural areas, and many deaths recorded in the latter under the head of "fever," more correctly classed as due to other diseases, such as dysentery and pneumonia. The mortality returns for Calcutta seem to lend support to this suggestion. It is stated that, "with the exception of fever, the mortality from the other death-causes was higher in Calcutta than in mofassil towns." In Calcutta there is a large number of medical practitioners, Native and European, who cannot fail to diffuse amongst the people in whose midst they practice some considerable knowledge of the diseases they are called upon to treat. This knowledge would tend to diminish the number of deaths referred to fever, and proportionately to increase the number credited to other diseases. The experiment carried out in the North-Western Provinces of obtaining from medical practitioners lists of deaths from diseases which they have been able to verify, shows very clearly that, if all deaths could be

referred to their exact causes, the number now credited to fever would show a marked decrease, whilst the numbers credited to other diseases would show a corresponding increase. The lesser fatality from fever recorded in Calcutta than in mofassil towns may thus, in part at least, be due to more accurate diagnosis. In the same way, the reference of deaths to fever may be somewhat less indiscriminate in mofassil towns than in rural areas. The question of the improvement of the record of the causes of death is a difficult one. Improvement will doubtless be slow of accomplishment; but the progress which registration of vital statistics has made in the Province of Bengal within the last six years encourages the hope that something may also be done to secure a more reliable record of the causes of mortality.

4. *Chief Diseases.*—The Province enjoyed unusual immunity from *cholera*. The deaths from this cause numbered 65,020 as compared with 196,247 in the preceding year. It was, however, present during the year in every district except one, and attacked 11,307 villages. If, therefore, the disease spreads by infection, as many believe, there were sufficiently numerous foci from which infection might be diffused. The special cause, or causes, of the unusual abeyance in which the disease remained during the year are still mostly matter of speculation. The Sanitary Commissioner gives his opinion in the following words :—"This happy result was chiefly due, I think, to the almost normal rainfall of the year and the satisfactory agricultural outturn almost everywhere, the people not being under the necessity of having to resort to polluted sources of water-supply and to unsuitable and unwholesome food which are the principal predisposing causes of cholera." The conditions stated are of a somewhat comprehensive character and such as would tend to lessen the predisposition to most diseases. With regard to the influence which the rainfall of the year may have exercised on cholera mortality, it is pointed out in the Government review of the report that in 1894, when the rainfall was almost the same as in the year under report, the mortality from both cholera and fever was the highest in the quinquennium. The Sanitary Commissioner seems to be on more secure ground when endeavouring to account for the comparative freedom from cholera of Puri, a place of pilgrimage, which always returns a high death-rate from this disease. "The immunity," he writes, "enjoyed by Puri in this respect was probably due to the improved sanitary condition of the place and to the opening of the East Coast Railway, which facilitated the rapid dispersion of pilgrims who congregate in Puri on the occasion of religious festivals several times a year." That crowds assembled under insanitary conditions are favourable to cholera outbreaks has been placed beyond dispute by the results of prolonged observation. It is no more, therefore, than might be expected that the dispersion of such crowds and the improvement of their sanitary environment would be unfavourable to its prevalence. The attempts to prevent cholera by the disinfection of wells by permanganate of potash are said to have had satisfactory results in the districts in which they were made. During the year, anti-cholera inoculation was performed on 4,296 emigrants to Assam; but no information regarding results was received up to the time the Sanitary Commissioner's report was written.

5. *Small-pox* was not unusually fatal. The 14,269 deaths recorded as due to it give a death-rate of only 0·20 per thousand of population. In Bengal, as in the other provinces in which measures had to be adopted with the object of preventing the spread of plague, vaccination suffered as a consequence of the need for employing officers of the Vaccination Department in superintending the carrying out of those measures. The plague inoculation scare and the introduction of the six-puncture system of vaccination are given by the Sanitary Commissioner as the causes to which the decrease in the number of vaccinations was chiefly due. The number of operations fell from 2,319,536 in the previous year to 2,147,452 in the year under report. "The extra two points of vaccination," writes Major Dyson, "were looked upon by the ignorant masses of the people as in some way connected with plague inoculation, and this retarded the progress of vaccination and accounts for the smaller number of operations performed during the past year." This is only another example of the difficulties which may have to be counted with when initiating harmless or even beneficial innovations amongst people so ignorant and conservative as the natives of India. The high percentage of successful cases, 97·99, is considered by Major Dyson to be due to the dishonest practice followed by vaccinators of including in the returns partial and even absolute failures as successful cases. Vaccinators in certain other provinces accomplish the same result in a somewhat different way: they omit their unsuccessful cases from their returns. In this way they show a high percentage of success without incurring the risk of detection which would attend the entry of unsuccessful cases as successful. Next to the absence of small-pox mortality, perhaps the proportion of infants vaccinated affords the best test of the efficiency of vaccination in a district. Judged by this latter test, the districts of Bengal show wide differences. Whilst in Malda the number of infants successfully vaccinated, per thousand, was as high as 856, in Puri it was only 24. Major Dyson does not see any reason why "with persevering care and tact on the part of the local officers, the ratio of successful infant vaccination cannot be much higher than at present." A satisfactory feature in the year's history of vaccination is the increasing use of vaccine lymph direct from the calf. The total number of vaccinations performed with this description of lymph increased from 175,001 in the preceding year, 1897–98, to 206,083 in the year under report. Commenting on a method of inspection of vaccination followed by some Civil Surgeons, in accordance with which the vaccinated children of several villages are assembled at one spot, the Lieutenant-Governor justly regards this as a most objectionable practice; "for it enables subordinates to set the seal of superior authority upon any concealment of deficiencies which a genuine inspection would have disclosed." The thorough inspection, case by case, of a single village would prove a more effectual deterrent against fraud than the inspection of a score of villages in the manner described. Indeed, slip-shod inspection is worse than no inspection; it gives confidence to dishonest vaccinators in the perpetration of fraud by showing them how easily such fraud may be concealed.

6. *Fever*, as in other years, was by far the most fatal of all the diseases. But the number of deaths assigned to it was less than in the previous year, and less than the average for the ten-year period 1888–97, "this being evidently due to the general healthiness of the year and to the plentiful outturn of crops almost everywhere." Accompanying this decrease in the prevalence of fever there was a falling-off in the quinine sales in the Province as a whole; but of the eight districts in which fever

mortality was higher than in the previous year, five show a corresponding increase in the sales of quinine. These facts seem to show that the demand for quinine arises from the belief the people have in its efficacy as a remedy for fever, and that its sale is not merely the result of official stimulus.

7. Doubtless from the same causes to which lessened fever prevalence was due, the mortality from *dysentery* and *diarrhœa* showed a decrease. The result of the examination of the returns furnished by medical practitioners who have recorded the causes of death in the cases treated by them, is to show that the mortality from bowel complaints is much understated. A more correct differentiation of the causes of death would increase the numbers attributed to dysentery and diarrhœa and correspondingly diminish the numbers credited to fever. Probably the greater mortality from bowel complaints recorded in towns as compared with rural areas is due, in part at least, to the more accurate diagnosis of disease in the former.

8. The expenditure on urban sanitation, excluding the construction and maintenance of roads, amounted to close upon twenty lakhs of rupees. The increase of expenditure on conservancy was largely due to "sanitary apprehension of the advent of plague." The four observation camps maintained with the object of preventing the introduction and spread of plague in the Province, alone cost nearly two and a quarter lakhs of rupees. At these camps 982,027 persons were examined and 39,023 detained. Yet, at only one of the four camps was there a single death from plague reported. At the Chausa camp there were five deaths from plague; at the other three, not one. Whether the results attained sufficiently compensated for so large an expenditure of money, and especially for so great an amount of unavoidable trouble and inconvenience to travellers, leaving out of count the indirect loss consequent on the interference with traffic, is a question which different persons might answer differently. Unfortunately, the exclusion of plague from the Province cannot be said to have been completely accomplished, although the measures adopted may have delayed the introduction of the disease.

9. *Summary.*—The year was characterised by generally normal meteorological conditions. The rainfall was seasonable, the harvest plentiful, and the prices of food grains lower than in the previous year. The influence of these conditions on the public health was shown in a marked decrease of mortality and, in the latter month of the year, in an increase of the birth-rate. There was lessened mortality from all the chief diseases. The number of deaths attributed to cholera was only about a third of the number recorded during the previous year, a result due, the Sanitary Commissioner thinks, to an almost normal rainfall and the satisfactory agriculture outturn almost everywhere. The mortality from small-pox was not high, reaching only to a ratio of 0·20 per 1,000 of population. Vaccination in Bengal, as in other provinces, suffered from withdrawal of some of the officers of the Vaccination Department to assist in carrying out the measures for plague prevention. The introduction of the method of making six punctures for lymph insertion had also the effect of creating suspicion in the minds of parents and rendering them averse from the submission of their children to the vaccinators. There was a considerable decrease in the total numbers vaccinated: these fall from 2,319,536 in the previous year to 2,147,452 in the year under report. Fevers and bowel complaints were less prevalent than in the previous year. The expenditure on urban sanitation, exclusive of the construction and maintenance of roads, fell little short of twenty lakhs of rupees. The establishment of observation camps with the object of preventing the introduction and spread of plague cost about two and a quarter lakhs of rupees. Apprehensions of plague invasion gave a wholesome stimulus to conservancy during the year.

29th May, 1900.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-Western Provinces and Oudh for 1898.

In marked contrast with its predecessor, the year 1898 was one of general prosperity and healthiness. The destructive effects of famine and disease were speedily obliterated, and the high death-rate of 1897 was followed in 1898 by the lowest on record, if that of 1893 be excepted. As the Secretary to Government puts it, the history of the year "primarily bears witness to the remarkable powers of recuperation shown by the people, and a rapid return to normal conditions, aided, it should be said, by an exceptionally healthy year and an unusual absence of epidemic disease." The principal meteorological features of the year did not deviate greatly from normal. At the majority of the stations at which complete meteorological records are kept, both the maximum and minimum temperatures were somewhat higher than the average. The rainfall during the first two and the last two months of the year was everywhere greater than during the corresponding months of the previous year. During the three comparatively dry months, March to May, the rainfall for the two years did not differ greatly; whilst during the monsoon period, June to October, the average fall was everywhere largely in excess of the average in the previous year, except in the western and submontane parts of the Province. In the latter, especially, there was a remarkable decrease from 92·44 to 47·45 inches. The table appended to paragraph 82 of the Report compares the prices of food grains for the 38 years commencing with 1861. Excluding wheat, the use of which is mostly limited to the well-to-do classes and cannot be regarded as one of the staple food grains of the bulk of the people, the mean price of these inferior grains was 18·19 seers per rupee as compared with 12·75 for 1896 and 10·25 for 1897. "These prices," writes the Sanitary Commissioner, "witness a return to prosperity." A study of the table of prices including the period from 1861 to the year under review

is suggestive. Whilst for the first 26 years of this period, the mean quanity of food grains which could be bought for a rupee was, during two of the years, over 30 seers, and during all of the other years, except seven, more than 20 seers; the quantity in the last 12 years of the period obtainable for a rupee only slightly exceeded 20 seers during two of those years, and for the remaining 10 years was always less, and often greatly less, than 20 seers. In other words, food is shown to be getting dearer. If the data were available, it would be useful if, in future tables of prices of food grains, an estimate were given of the movement of wages accompanying the movement of prices of food.

2. The birth-rate recorded for the year under review, calculated on the census figures of 1891, rose from 31·10 in the previous year to 37·35 in the year under review. The number of births exceeded the number of deaths by no fewer than 467,406, "giving a rate of excess of 9·97 *per mille*." It is interesting to notice that during the first seven months of the year, the birth-rate was below the rate for the corresponding period of the preceding year, a result due, no doubt, as the Sanitary Commissioner observes, to the enfeebled condition of the people during the seven months preceding November, 1897. The last five months of the year, however, show a high birth-rate as compared with the corresponding months of the previous year, indicating the return to health of the people when the famine conditions had passed away.

3. Whilst, as stated, the birth-rate showed a marked rise during 1898, the death-rate, on the other hand, fell from 44·46 per 1,000 of the population to 27·38. There were 613,273 fewer deaths recorded than in 1897. The death-rate was lower than the quinquennial mean by 6·52 *per mille*. Some of the districts with the lowest death-rates were those which had suffered severely from famine, and the Sanitary Commissioner considers it satisfactory to see these districts in the list. During a severe famine many of the diseased and feeble disappear, leaving a population composed of the most healthy and robust. In such a population the mortality may be expected to be unusually low. There is, perhaps, no more sensitive index of increased or decreased healthiness in a community than the rise or fall of the death-rate amongst infants. In 1897 this rate was 272·5; in the year under review it was only 224·0.

4. The result of the endeavour to differentiate the causes of death by a professional agency tends to confirm the conclusion that the number of deaths recorded under the heading of "fever" by chaukidars and other unprofessional agents is excessive; whilst the number under other headings, such as diarrhœa and dysentery, pneumonia and lung diseases, &c., are correspondingly under-stated. Although this conclusion is established beyond any question, it is not very clear how improvement in the differentiation of disease is practicable unless at prohibitory expense. One of the results of the verification of deaths by professional agencies is worthy of special attention. It is frequently suggested as an explanation why deaths from enteric fever amongst natives are so rarely recorded, that the disease is largely prevalent amongst native children, and that having generally had an attack in infancy, native adults enjoy comparative immunity from the disease. This hypothesis seems hardly to be borne out by the records tabulated by professional agencies. "In all, 9,254 cases were verified, of which 4,103 were children under 16 years of age." Of these 9,254 deaths, two only were from enteric fever; and apparently, judging from the statement made in paragraph 25, neither of these occurred amongst the 4,103 children under 16 years of age. The theory, therefore, that widespread prevalence of enteric fever amongst native children may be assumed to account for the rarity of that disease amongst adults receives no support from the record of the causes of death furnished by professional agencies.

5. There was a remarkable immunity from epidemic disease during the year. Of *cholera* deaths only 2,508, or equal to a ratio of 0·5 per 1,000 of population, were recorded. During the months of the year when cholera is generally most prevalent, the number of deaths from it was insignificant. The months of greatest mortality were October and November, the latter being credited for the first time during the entire period included between 1877 and 1898, with the highest rate for any month of the year. It might have been useful to endeavour to account for the unusual abeyance in which the disease remained during the year. An investigation of the conditions determining or influencing its absence during particular seasons, might lead to results hardly less valuable than those to be obtained by inquiries into those determining its prevalence. Cholera deaths were reported in the Province every month of the year, but out of a total number of 107,132 villages, in only 516 were deaths due to it recorded. The cause of this comparative quiesence of the disease and its apparent inability to spread during 1898 remain as much a mystery as, during other years, does the cause of its rapid development and dispersion.

6. As in the case of cholera, so also in that of *small-pox*, there was a remarkable immunity from epidemic prevalence. Only in one of the past 28 years have fewer deaths from small-pox been recorded. In 1897 the small-pox deaths numbered 87,127. In the year under report the number was only 2,419. The great prevalence of small-pox in the preceding year explains to some extent the comparatively small mortality caused by it in the year under report. According to Farr, of every 1,000 persons attacked by small-pox from 150 to 300 die, or from 15 to 30 per cent. of the cases terminate fatally. Taking 20, a percentage intermediate between the two extremes given by Farr, as representing the deaths to attacks in India, it would follow that the total number of deaths from small-pox in 1897 would represent 435,635 attacked by the disease. All of those attacked but who survived would be protected against future attacks; consequently, by no means an insignificant portion of the unprotected must have been rendered proof against further attack by the epidemic of the preceding year, and so have substantially lessened the number of those susceptible of attack in the year under report. The Annual Report on Vaccination for the year 1898–99 shows that the ground lost during the preceding year had not yet been entirely recovered. During 1897–98, the total number of successful primary vaccinations fell, under stress of famine conditions, from 1,308,941 to 1,182,395. With the return of prosperity and the release of the members of the vaccination staff from the extraneous duties imposed upon them in connection with plague, the numbers successfully vaccinated again rose to 1,227,261, showing an increase over the preceding year of 44,708, but failing to reach the total of 1896–97 by no fewer than 81,680. The quality of the work, however, which had

fallen off in the famine year at the same time that the quantity had decreased, was not only restored, but was in advance of that recorded in 1896–97. During the latter year the percentage of successful cases in primary vaccination, where the result was known, was 94·65: in the following or famine year it fell to 93·74, but rose in the year under review to 94·96. The number of successful re-vaccinations remained practically the same in 1898-99 as in the preceding or famine year, and fell short of the number for 1896–97 by 10,487. One of the most promising features of the year's work is the increase in the number of infants successfully vaccinated. Whilst in 1896–97 these numbered 578,055 and in the following year 551,113, they increased during the year under review to 637,129. Obviously, however, when even the latter number is compared with the 1,751,725 births recorded in the calendar year 1898, prolonged and sustained effort will be required before anything approaching to the complete protection of the infant population of the Province can be attained. After deducting the 359,621 deaths of children under one year of age, there would remain available for vaccination 1,392,104, as compared with the 637,129 successfully vaccinated. The Government of these Provinces, no doubt for sufficient reasons, still trusts mainly to the use of humanised vaccine lymph. "Meantime, the arrangements hitherto existing have continued, under which vaccination operations are carried on in the hills in the hot weather and rains, and human lymph thus obtained is despatched to the plains in September and October. There are bovine lymph depôts at Allahabad and Lucknow, but, owing to the difficulty of preservation, the extent of these operations is local." This acquiescence in the continued use of human lymph finds little favour elsewhere. In the review of vaccination for 1894–95, the Secretary to the Madras Government writes:—"Every effort should be made to discontinue the use of human lymph; that this should still have been employed in such districts as Ganjam, Godavari, and Vizagapatam, where there are hill tracts remote from centres from which lymph can be obtained, is capable of explanation; but this is not the case with Nellore, where, if proper arrangements were made, there should have been no need to use lymph obtained from the human subject." Calf lymph, unless used direct from the calf to arm, gives a low percentage of success. "Calf lymph in tubes," writes the Officiating Sanitary Commissioner of the North-Western Provinces, "unmixed with any preservative has not good keeping qualities in this climate." He adds:—"Very thorough supervision, and a training in antiseptic methods far in advance of that given to vaccinators, are required in the preparation of lymph preserved by admixture." This would seem to be borne out by results. The following is the experience recorded in the Madras Presidency for the year 1898–99:—"As usual fresh animal lymph shows the greatest percentage of success, viz., 97·6; then comes vaccine sent out between glass plates without any preservative, then lanoline paste, and lastly glycerine, with 95·9, 88·0, and 82·4 respectively." Seeing that, with the experience gained in the preparation of this mixture, a percentage of only 82·4 of success follows its use, further endeavour would still seem to be needful before it can come anywhere near to the level of success claimed for bovine or humanised lymph "without any preservative."

7. "In the year under review," writes the Secretary to Government, "the monthly mortality took a thoroughly normal course, which is, in every year, regulated in the main by the vast preponderance of the deaths under the head of fever in these Provinces." The deaths from *fever* during the year were fewer by 400,120 than in the preceding year, a decrease of 27·3 per cent. So with *diarrhœa* and *dysentery;* the deaths recorded as due to these fell from 58,822 in the previous year to 23,574, or less than half. The latter figures indicate that to hard times and an insufficient or unwholesome dietary, a season of comparative comfort and abundance had succeeded.

8. An outbreak of plague occurred in the town of Jwalapur, near Hardwar. The first case took place on the 9th of January, and the disease did not finally disappear before the 28th of May. The measures of evacuation, segregation, and disinfection which were energetically put in force, appear to have had the effect of preventing the spread of the disease beyond the town first attacked and the neighbouring villages.

9. The chief sanitary defects in the municipalities of the Province, as well as the remedial measures adopted for their removal, are succinctly described in Annual Form XI. The report of the Sanitary Engineer is largely taken up with an account of the working of the municipal waterworks in the Province. The Sanitary Board, which met three times during the year, have recorded their satisfaction with the quality of the water delivered by the several waterworks, but have recommended that samples should be sent monthly from each of the municipal waterworks for qualitative examination by the Government Bacteriologist.

10. *Summary.*—Unlike its predecessor, which was a year of famine and great mortality, the year under review was one of prosperity and exceptional healthiness. Whilst the death-rate fell from 40·46 in the previous year to 27·38, the birth-rate rose from 31·10 to 37·35. The absence of epidemics of disease was one of the marked features of 1898. The number of deaths from cholera was the lowest recorded since trustworthy registration began in 1871. Small-pox, which carried off 87,127 of the population during the previous year, was accountable for only 2,419 deaths. So, likewise, with regard to fever and bowel complaints; whilst the former was credited with 400,120 fewer deaths than in 1897, dysentery and diarrhœa caused less than half the number of deaths. The energetic and drastic measures adopted with the object of circumscribing and extinguishing an outbreak of plague near Hardwar were completely successful. By the end of May the disease had entirely disappeared. Water-supply and drainage schemes continued to occupy the attention of the Government. Although considering the water supplied by the municipal waterworks to have been satisfactory during the year, the Sanitary Board recommended that samples should be sent monthly by each municipality to be qualitatively examined by the Government Bacteriologist. This proposal has received the sanction of the Government. The great drainage works at Benares continued to make progress, and surveys of several important towns were being carried out or completed with a view to the introduction into them of an improved system of drainage.

25th May, 1900.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1898.

Excepting in two statements, given in the Appendix, recording the rainfall at the headquarters of the 31 districts of the Province and the prevailing rates of wheat, rice, and gram, no reference is made in the Report to the meteorology of the year. In view of the intimate connection which is acknowledged to exist between the weather and the state of the public health, it might not be out of place if in future reports the Sanitary Commissioner devoted a paragraph to a brief sketch of the chief meteorological features of the year. In the same paragraph might also be noted whether the ordinary food grains were plentiful and cheap, or the reverse; and whether the wages of the labouring classes showed a rise or fall. The sanitary history of a year can hardly be considered to be complete unless it gives some account of the influence which the weather, prices of food, and wages of the labouring classes seem to have exercised on the public health during that year. From the two statements already referred to it would appear that the total rainfall in 1898 was nearly the same as that in the previous year; in the former 24·14 inches of rain were recorded, and 23·62 in the latter. In both years the fall was considerably below the average of the previous 10 years, which was 27·77 inches. In every quarter of the year under report, wheat, rice, and gram were cheaper than during the corresponding quarters of the preceding year; whilst the mortality was greatly higher during the first two quarters of 1898, somewhat higher during the third, and greatly lower during the last quarter than in the corresponding quarters of 1897.

2. The *birth-rate* for the year, 41·0, shows some falling off as compared with that of the previous year, when it was 42·6 per 1,000 of population; but was again the highest recorded in any province in India. There is a wide divergence between the rates recorded for different districts. Three districts record birth-rates exceeding 53, and two districts birth-rates less than 30 per 1,000 of their population. In the latter two the conditions are exceptional. In the population of one of them, Simla, males largely preponderate; and in the other, Peshawar, the population consists chiefly of "Muhammadans of the Afghan type," who are averse to register their births and deaths, female births more particularly. In the chief towns of the Province also there is a wide divergence between those recording the highest and those recording the lowest birth-rates. Whilst Sialkot and Chunnian are credited with rates of 53 and 54 respectively, Kohat and Dera Ghazi Khan fail to reach to half of these rates, and record respectively 26 and 23 *per mille* of their populations. In the Government review of the Report the fluctuations between the birth-rates recorded in the year under report and those recorded in the previous year are noticed, and the comment added: "The fact that the calculations have to be made on the figures of the census of 1891 accounts for a great deal in these days, when great changes are going on in consequence of the construction of railways and canals." If the Sanitary Commissioner can succeed in securing an accurate record of children born dead, according to their sex, there is no doubt, as he observes in the concluding sentence of the fifth paragraph of his report, that in such a record might be found a clue to the detection of infanticide in those places where this crime is still practised.

3. The *death-rate* for the year was practically the same as in the previous year. As the birth-rate was the highest recorded in any Province of India, so likewise was the death-rate of 31·05 the highest in any Province, except Assam. A high birth-rate is usually accompanied by a high death-rate. A glance at the tables on pages 1 and 4 will show that the 10 districts with the highest birth-rates include 7 of the 10 districts with the highest death-rates. The district of Dera Ismail Khan is a notable exception; it records a birth-rate of 30·6, nearly the lowest in the Province, and yet has the highest death-rate, 40·11. "Although the district has a bad reputation for a virulent form of fever," writes the Lieutenant-Governor, "it seems possible that there may be something wrong about the figures." The death-rates varied greatly in the several districts, but within narrower limits than the birth-rates. Dera Ismail Khan records the highest death-rate, 40·11, and Montgomery, 21·27, the lowest. As measured by their record of mortality, the 45 principal towns, taken together, were healthier than during the previous two years; yet does their death-rate of 34 considerably exceed the provincial rate of 31·05. The greater healthiness of the rural as compared with the urban population is further shown by a comparison of the infant mortality in town and country. In the 45 principal towns of the Province the ratio of mortality amongst infants was 245 per 1,000 of children born; in the country the ratio was 226 per 1,000. The town of Dera Ismail Khan records the enormous death-rate amongst infants of 400. The chief sanitary defect noted in the case of this town is the unsatisfactory state of the drainage; the water supply is said to be good and sufficient.

4. *Registration of vital statistics* continues to receive much attention, and with results which are highly satisfactory. The Sanitary Commissioner shows that, although the death-rate amongst infants in England is far below the rate recorded in India, yet the *proportion* between the infant and general death-rates in England is very nearly the same as in India, "a point," he adds, "which goes to show how steadily the system of registration is improving in this Province."

5. *Chief Diseases.*—Although it is customary to give *cholera* a foremost place in the list of the chief diseases in the Provinces of India, it is only at long intervals that this disease is the cause of more than an insignificant mortality in the Punjab. During the year under review "the Province was practically free from cholera." With the exception of the 30 deaths in Umballa cantonment, there were only three deaths recorded in the entire Province. That the disease should have appeared in, and restricted its spread almost exclusively to, a military cantonment, with its elaborate system of sanitation carefully carried out under expert supervision, seems not a little remarkable.

6. The number of deaths due to *small-pox* fell from 45,084 in 1896 to 16,077 last year, and now, in the year under report, to 4,998, showing that the severe epidemic of 1896 is dying down. The Sanitary Commissioner points out that the small-pox chart shows at a glance the diminished prevalence of the disease during the period from 1879 to 1898, as compared with its prevalence during the preceding series of years from 1867 to 1879. This diminished prevalence since 1879 coincides, he adds, with the institution of the Vaccination Department as it is at present. Yet it cannot be overlooked that, even under the existing system of vaccination, violent epidemics are still possible. The deaths from small-pox in 1896 reached a rate of 2·19 per 1,000 of population, and was not exceeded in any year since 1869. Vaccination, owing to several causes, cannot be said to have made much progress during the year under review. In fact, if the total number of persons vaccinated in 1898–99 be compared with the total numbers for each of the two preceding years, it will be seen that there has been not only no increase, but a decrease. As compared with the previous year, the decrease amounted only to 4,623 cases ; but as compared with 1896–97, to no fewer than 61,545 cases. During each of these three years the strength of the Department remained practically the same. The cause of the falling-off in the numbers vaccinated is thus explained in the Government review of the report. "Doubtless the absence of the Deputy Sanitary Commissioner on plague duty, and the consequent want of supervision over the vaccinators, had much to do with this falling-off ; perhaps also the partial change of system to working in bodies, to be referred to presently, instead of in pairs, had something to do with it." A perusal of the record of their opinions regarding the system of setting the vaccinators to work in bodies rather than in pairs, with the object of securing their better supervision, shows that the Civil Surgeons are by no means unanimous regarding the superiority of the former system. The Lieutenant-Governor has, however, no objection to giving the system of working in bodies a further trial, but thinks that all of the Civil Surgeons do not understand precisely what the system is meant to be, and has instructed the Sanitary Commissioner to put more clearly before them what the system is, and how it is to be worked. In addition to the other causes mentioned as having had an unfavourable effect on the season's work, the failure of the animal lymph preserved in vaseline is noted. Regarding this, the Sanitary Commissioner writes :— "This is a matter in which we must expect a good deal of antagonism ; but having worked with it so successfully myself when I was Civil Surgeon in Rawal Pindi, I can only say that when proper arrangements are made, and our depôts properly fitted with the necessary appliances, and under good supervision, this all disappears." This may be true, but, with the agents at his disposal, it is at least doubtful if the conditions necessary to secure success can in practice be counted upon. Elsewhere in his report, the Sanitary Commissioner states that almost every vaccinator in the province *hates the system*. If the working of the system has of necessity to be entrusted to agents who hate it, success can hardly be looked for with confidence. In the neighbouring North-Western Provinces, the use of vaccine lymph preserved in glycerine has not been satisfactory. The reasons for this, which have been stated in the Vaccination Report for those Provinces, are worthy of attention. The use of calf lymph preserved in glycerine has been persevered with in the Madras Presidency for many years ; but with, as result, a comparatively low percentage of successful cases. The percentage of successful cases in primary vaccination in the Punjab was 95·50, as compared with 95·10 in the previous year, and with 93·97 in 1896–97. The percentage of success in secondary vaccination, on the other hand, fell from 59·21 in the previous year to 58·85 in the year under report. This falling-off probably merely indicates that more care is taken to see that vaccinators do not record every case showing some degree of local irritation at the point of lymph insertion as "successful."

7. Cases of *plague* continued to occur throughout the year, but they were confined to very limited areas in the districts of Hoshiarpur and Jullundur. The total number of deaths caused by the disease fell somewhat short of 2,000.

8. *Fever*, *dysentery*, and *diarrhœa* prevailed to much the same extent as in the previous year. The district of Dera Ismail Khan records the high death-rate of 32·26 from fever. The result of the revised scheme for placing quinine more within reach of the people in remote places will not be known, it is stated in the Government review of the report, until the end of the current year.

9. *Sanitary Works.*—The list of water-supply and drainage schemes, completed or in progress during the year, shows that many useful sanitary works of a permanent nature are steadily being carried through. The expenditure under the two heads of water-supply and drainage amounted to close upon two lakhs of rupees. In commenting on the statement prepared for the purpose of showing the influence on the health of towns and rural circles of the introduction into them of drainage or water-supply schemes, or both, the Sanitary Commissioner says :—"With very few exceptions, the statistics show a marked improvement in the health of the towns in which the water-supply was introduced. It is only after some years that the people take to using pipe water ; one great objection to pipe water is that it is so much warmer than well water." The improvement effected by the water-supply in Delhi, Umballa, Lahore, and Haripur has been very marked.

10. The experiment of endeavouring to excite an interest in sanitation in rural districts by granting rewards in the form of remissions of a considerable fraction of the revenue demand of the one village in each tahsil of the district which showed the best results in sanitary improvement is, we are glad to see, to be persevered with. Such a method of inducing the people to pay attention to their sanitary surroundings seems to be free from many of the dangers of the more drastic methods of enforcing sanitary improvements which find favour in some quarters. Time and patience are necessary elements in schemes having for their object to induce the people of India to relinquish their ancient habits and customs in favour of new ones. The Sanitary Board did not meet during the year. It possesses only consultative functions, and the general feeling amongst the members seems to be that without executive powers, meetings would be without useful result.

11. *Summary.*—The sanitary history of the year is fortunately undiversified by a record of famine or violent epidemics of disease. The birth-rate was the highest recorded in any province of India, and the death-rate was only exceeded in Assam. A high death-rate is the usual concomitant of a

high birth-rate. The recorded birth and death rates in the Punjab testify to the high degree of accuracy in the registration of vital statistics which has been reached in that Province. Of the chief diseases, cholera was practically absent, only 33 deaths having been attributed to it. Plague never succeeded in getting outside the narrow limits within which it was confined in portions of the two districts of Hoshiarpur and Jullundur. It was credited with just under 2,000 deaths. The violent small-pox epidemic of 1896, which had continued to decrease in fatality in the following year, further declined in the year under report, when it accounted for only 4,625 deaths. Vaccination cannot be said to have made much progress; the total number of persons vaccinated shows a slight decrease as compared with the total number for the previous year, and a more serious decrease as compared with the number for 1896–97. For this unfavourable result several causes are assigned, and amongst them the want of success in the use of the vaccine lymph preserved in glycerine. The Sanitary Commissioner describes the causes which contributed to the failure of the lymph thus preserved, and mentions the arrangements which, he believes, would secure its success. But as he states that the vaccinators are hostile to the use of vaccine lymph preserved in glycerine, the attainment of the success which he hopes to secure is probably some way off. Fevers and bowel complaints were not more fatal than ordinary. The endeavour to place quinine within easier reach of the people in remote parts of the Province is being persevered with. Steady progress is being made in the prosecution of sanitary improvements throughout the Province. The list of drainage and water-supply schemes is a long one. The effort to induce the rural population to bestow more attention on the sanitary improvement of their villages, by offering rewards in the shape of the remission of portions of the revenue demand, is being pressed upon the attention of the district authorities.

25th May, 1900.

No. 5.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1898.

The history of the year from a sanitary point of view was not very eventful. It is only by degrees that registration of vital statistics is being extended to those parts of the Province, the last brought under British rule. The districts included in Lower and Upper Burma now number 38, according to Statement No. 1 of the Vaccination Report, but in 18 only of these are births and deaths recorded. From the Government Resolution on the Sanitary Report we learn that "registration of births and deaths has been extended to three municipal towns in Upper Burma, making 12 towns in all in which full statistics are recorded." A commencement has also been made, from January of the year under review, with the registration of deaths, but not also of births, in selected districts of Upper Burma. Seeing that in parts even of Lower Burma arrangements for the record of vital statistics are still incomplete, it will probably be some years yet before a system of registration can be introduced into all the districts of Upper Burma, the most recently acquired portion of the Province. The part of the population of Burma already brought under registration is stated to be 4,510,697, a number which differs slightly from that given in the previous year, owing to the changes described by the Sanitary Commissioner in paragraphs 4 and 5 of his Report. On these figures the ratios of births and deaths throughout the Report are calculated.

2. The *birth-rate* for Lower Burma was 34·11 per thousand of its population, as compared with 31·82 for the previous year. Referring to the table given in paragraph 11 of the previous year's report, it will be seen that the birth-rate for the year under review is the highest yet recorded in Burma, the next highest having been 32·27 in 1896. This shows that registration, under the persistent attention bestowed upon it, is steadily improving in the Province. In the table just mentioned, the progress which the registration of births and deaths has made during the past 26 years may be clearly traced. In 1873 the recorded birth-rate, per thousand of population, was 18·45, or little more than half of that now reached. But it is certain that the increase in the birth-rate is not altogether due to better registration. "The country is being rapidly opened up and the population, both urban and rural, is increasing very fast through excess of births over deaths, and immigration." It must follow that, during the latter years, more especially of the ten-year inter-census period, the births, resulting as they do from a larger population, will be more numerous than in the preceding census year; whilst the smaller census population figures are still used as the basis on which the ratio of births is calculated. The births of a larger population calculated, not on the population which furnishes them, but on a smaller one, will, it is evident, have the effect of giving a ratio higher than it ought to be. If the increase of the population were due to excess of births over deaths alone, the population could be estimated by adding this excess to the population of each preceding year; but in Burma immigration seems to play a very important part in raising the strength of the population, and it is not known if a complete record of immigrants is kept.

3. The recorded *death-rate* of 26·13 was practically the same as that of the previous year. As with births so with deaths, there has been a remarkable improvement in their registration during the last 26 years. Likewise, and from the same cause—increase of population since last census—the ratio of deaths, calculated on the smaller census population, is higher than the ratio would be if calculated on the greater population of the year under review. Growth of population thus combines with improved registration of vital statistics to raise the recorded birth and death rates. As the Sanitary Commissioner points out, some of the apparent anomalies in the birth and death rates in the towns of the Province can be explained by the relative proportions of the sexes in

these towns. Rangoon, for example, records a birth-rate of only 18·77, as against a general urban birth-rate of 25·78 for the Province. It cannot be supposed that in the chief town of the Province and the seat of Government registration of vital statistics is more backward than in other towns. If additions to the population of Rangoon through immigration tended to raise the birth-rate, the rate would undoubtedly be a high one. The explanation of the abnormally low birth-rate is to be found in the circumstance that females constitute less than 31 per cent. of the population of Rangoon town. Contrary to the rule that a high birth-rate usually accompanies a high death-rate, "the lowest birth-rates and the highest death-rates are returned by towns." In Burma, the urban birth-rate was 27·78 *per mille* of population, and the death-rate 33·10; whilst the rural birth-rate was 35·34, and the rural death-rate 25·09. We have, thus, results the exact opposite of those that might have been expected. When, however, the constitution of the urban is compared with that of the rural population, one at least of the causes of these abnormal ratios is revealed. In the urban population of the Province, to every 100 females there were 155 males; and in the rural population to every 100 females 107 males. So far from the seemingly abnormal ratios of births and deaths in towns being due to more defective registration than in rural areas, the Sanitary Commissioner believes that urban is more accurate than rural registration. Certainly, a death-rate in rural Burma of 25·09 seems less likely to be an approximation to the actual ratio than 33·10 in urban Burma. As in the Indian Provinces, the mortality amongst infants is high and continues to rise. Of male children under one year of age 287·35 died *per mille*, and of female children 193·96, as compared with 269·24 of the former and 188·29 of the latter in the previous year. How far this increase in the infant death-rate from 228·93 of male children and 161·42 of female children in the preceding five-year period 1893–97 is due to greater infant mortality and how far to improved registration is uncertain.

4. *Chief Diseases.*—Burma was no exception to the rule that the year under report was one of low *cholera* mortality thoughout the Indian Empire generally. The number of cholera deaths recorded fell from a total of 8,538 in the previous year to 2,972 in the year under review, and was the lowest recorded since 1893. Commenting on the unsatisfactory results of the inquiries hitherto made regarding the origin of the outbreaks of cholera in jails, the Sanitary Commissioner advises that specialists should be promptly be made available for the purpose of thoroughly investigating on the spot epidemics of cholera occurring in jails. In our memorandum on the Sanitary Report of the Central Provinces for 1895, when dealing with the question of the importation of cholera into five of the jails in which the disease had appeared, we wrote :—"We have thus five groups of people under the constant observation of scientific experts, and yet cholera appears in each group without its having been possible to trace the cause of its appearance. We may well hesitate, therefore, to accept the confident assertions made regarding the importation of the disease into villages or into fairs, such assertions resting in most cases on statements obtained from ignorant villagers or village watchmen." Inquiries by specialists on the spot into the origin of the outbreaks of cholera in jails, as recommended by the Sanitary Commissioner, would seem likely to afford more useful results than those obtained regarding outbreaks in towns and villages in which the conditions needful for exact observation of all the facts can seldom be present. An inquiry into the cause, or causes, to which the comparative abeyance of cholera during 1898 was due, might prove as useful in increasing our knowledge of the disease as an inquiry into those which determine its prevalence in years of its epidemic prevalence.

5. One has to go back to 1884 before coming to a year which records so high a mortality from *small-pox* as the year under report. The deaths from this disease numbered 4,826, as compared with 1,950 in the previous year. Of the victims, 69 per cent. were infants or children under twelve. Vaccination continues to make satisfactory progress both as regards the numbers vaccinated and the percentage of successful cases. From a ratio of 27·73 per 1,000 of the population protected against small-pox in 1893–94, the ratio has reached in 1898–99 a ratio of 53·03. The increased amount of work recorded is in part due to the increase in the strength of the vaccination establishment; but, apart from this increase, the number of operations performed by each vaccinator has risen from an average of 2,526 in the previous year to an average of 2,635. At the same time, the percentage of success in revaccination cases fell from 61·38 to 59·55. This fall in the percentage of success is probably only an indication that the tests by which success in revaccination is determined have been somewhat more stringently applied. If such be the true explanation the decrease is not a matter for regret. Judged by the amount and quality of the work recorded, vaccination, as we have said, is making good progress; but judged by the practical test of the measure of protection against small-pox which it has conferred on the population, there is less room for satisfaction. The ratio of small-pox deaths, per thousand of population, in the calendar year 1898 was 1·07, as compared with 0·44, the mean ratio of the previous five years; and the number of small-pox deaths is the highest recorded since 1884. The extraordinary falling-off in the number of persons vaccinated in the town of Rangoon from a total of 16,083 successful primary operations in 1895–96 to 5,516 in 1898–99, is said by the Health Officer to be for the most part only apparent and not real, as the accuracy of the figures of 1896–97 and the previous years is, in his opinion, open to grave doubt. Accompanying this decrease, apparent or real, the small-pox deaths in the town reached a total of 132 during the year under review. Except in three municipal towns, of which Rangoon is one, in all the rest the number of children vaccinated exceeded the number estimated to be available for vaccination. This excess is explained to be due, in the first place, to large numbers of children having been brought from the adjoining villages into the town to be vaccinated, and to a practice which is, or was, common elsewhere in India, of municipal vaccinators, on their completing the vaccination of all persons available in the towns, extending their operations to the surrounding villages, and including the persons vaccinated in these latter in the returns for the municipal towns.

6. The number of deaths caused by *fevers* was the highest on record. This may not be altogether due to increased fever mortality, but may be partly the consequence of more complete registration and partly of growth of population. No doubt a large proportion of the deaths ascribed to fevers would have been recorded under other heads had the record been made by persons possessed of some medical knowledge. The Sanitary Commissioner thinks 50 per cent. of the deaths credited to fevers

were really due to other causes. The scheme for the distribution of quinine, so as to place it within reach of the people of remote tracts of the country, is still being persevered with, although the Lieutenant-Governor is disappointed to learn that it has progressed less than it might have done. The mortality from *dysentery and diarrhœa* was slightly less than in the preceding year and seems to call for no special remark.

7. Up to the end of the year, only one case of *plague*, and that an imported one, had appeared in the Province. Appended to the Sanitary Report, and covering nearly nine closely-printed pages, is an elaborate list of precautions to be used against the importation of plague and of rules for the prevention of its spread in towns and villages. The rules for dealing with the segregation of the sick, their removal to hospitals, and for the disinfection of houses in which cases of the disease have occurred, unless worked with much discretion, may not have the effect desired of restricting the diffusion of the disease. Experience shows that to avoid the inconvenience arising from the strict enforcement of these rules, the people are prone to conceal their sick, and even to abandon their homes, carrying with them in their flight the seeds of the disease to towns and villages hitherto free from infection.

8. *Sanitary Works.*—The list given in Annual Form No. X. of the Appendix to the Report of Sanitary Defects in the Municipalities of Burma, is a long one, and the Sanitary Engineer whose services have now been placed at the disposal of the Government will find ample employment for his energies for years to come in the task of removing them. There seems to be some prospect of a reorganisation of the superior medical staff of the Province being effected in the near future. It is not reasonable to expect that under the existing system, in accordance with which the same officer has charge of the Sanitary, Medical, Jail, and Vaccination Departments, sanitation could receive the amount of attention which its importance deserves in a great and rapidly developing province like Burma. "The Sanitary Board is reported to have done practically nothing" during the year under review.

9. *Summary.*—The sanitary history of the year was marked by no very unusual events. In a comparatively new province like Burma, a large portion of which has only recently come under British rule, it will probably take years of patient labour to bring its vital statistics into line with those of the older provinces. In Upper Burma, little more than a commencement has yet been made in the registration of vital statistics. Even in Lower Burma, the older part of the province, returns of births and deaths for the entire population are not yet available. The birth-rate for Lower Burma, during the year under report, was equal to a ratio of 34·11 per thousand of the population, and the highest hitherto recorded. This high rate indicates improvement in registration, and also, it is believed, increase in the numbers of the population since last census was taken, an increase due partly to excess of births over deaths, and partly to immigration. The recorded death-rate was 26·13, and was practically the same as that of the previous year. Some of the apparent anomalies in the birth and death rates the Sanitary Commissioner shows to be due to the peculiar constitution of the communities furnishing those rates. For example, in Rangoon town, which records a birth-rate of only 18·77 *per mille*, females constitute less than 31 per cent. of its population. Burma shared the comparative immunity from cholera during 1898 enjoyed by the Indian Empire generally. Not since 1884 has small-pox been so fatal as in the year under report. The numbers vaccinated during 1898–99 show a considerable increase, whilst there is, at the same time, an improvement in the percentage of successful cases in primary vaccination. In Rangoon alone, of all the towns, is there any very marked decrease in the numbers vaccinated. This decrease the Health Officer is inclined to regard as more apparent than real, and due to the fact that the accuracy of the returns of vaccination in 1896–97 and the previous years is open to grave doubt. The number of fever deaths was the highest yet recorded. This high mortality from fever may have been, in part, due to better registration, and also in part to growth of population since last census. Up to the end of the year only one case of plague, and that an imported one, had appeared in the Province. A sanitary engineer was appointed for the Province from the beginning of the year. Provided adequate funds are placed at his disposal, there should be ample scope for his services in the new and rapidly progressing Province of Burma.

25th May, 1900.

No. 6.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Central Provinces for 1898.

As the previous year of famine and sickness was the most disastrous to life of any hitherto recorded, so was the year under review the healthiest "which the Province has known during the past quarter of a century." The mean rainfall was 50·89 inches, or only 0·87 below that of the last 32 years. But from this statement no conclusion regarding the effect of the rainfall on the harvests of the Province, as a whole, can be drawn. In the Jubbulpore district, for example, "the rainfall was well distributed, and there were breaks at convenient intervals which benefited the *kharif* crop." As a consequence of the favourable rainfall, food was cheap, pressure was removed from the poorer classes, and the health of the people improved. Yet, in the adjoining district of Damoh, in the same division, "though the rainfall was heavy, it was not seasonable, and consequently did not do as much good to the crops as the monsoon of the year previous, but it benefited the rice crop, of

which there was a bumper harvest." The useful summary of the meteorology of the year given by the Sanitary Commissioner shows that the several districts of the Province were very differently affected by the season's rainfall; but that, whilst some crops partially failed, others succeeded, and as the general result, the food supplies were more plentiful and much cheaper than in 1897.

2. The *registration of vital statistics*, whilst continuing to be effected as heretofore, was extended to and carried out in *Zamindari* tracts with greater accuracy than had been previously possible. The Sanitary Commissioner has, however, considered it inexpedient to include the statistics from these tracts in the year's returns, as their general accuracy is still open to question, and the combined figures could not be conveniently used for the purposes of comparison with those of previous years. The time of taking the next census might be a convenient period from which to commence the incorporation of the vital statistics of the *Zamindari* tracts with those for the rest of the Province. Up to and during the year 1895, the population, since the taking of the census in 1891, normally increased from 9,531,560 to 9,718,030. From 1895, a series of calamitous seasons rapidly reduced the numbers, until, in the year under review, the population is estimated to number only 9,076,626. This estimate is arrived at by adding to, or subtracting from, the population figures of each preceding year, the annual number of births in excess, or in defect, of the annual number of deaths. It is not improbable that the reduction in the population numbers may be even greater than the estimate. It is certain that, during the time when distress was most acute in the Central Provinces, many of the inhabitants migrated into other provinces in quest of the means of subsisteuce. In this way, emigration may have had a not unimportant influence in bringing about a considerable, although not accurately known, reduction of the population below the estimated number.

3. The course of the *birth-rate*, when followed month by month throughout the year under review, is seen to be strikingly similar to that observed in the other provinces simultaneously afflicted by famine. During the first seven months, the number of births continued to be far less than the number in the corresponding months of the preceding year; during the last five months, on the other hand, under the influence of the better times which set in towards the end of the previous year, the number of births shows a remarkable increase over the number in the corresponding months of 1897. The effect of this increase in the birth-rate in the last months of 1898 was not only to compensate for the deficiency in the first seven months, as compared with the corresponding months of the previous year, but to bring about an excess of 29,203 in the totals for the year over the totals for 1897. "There was marked evidence in the birth returns," writes Colonel Hutcheson, "that the generative and recuperative power of those whose constitutions were not injuriously affected by want and privation, became active towards the close of the previous year and increased in the early months of 1898 to such an extent that the birth-rate during the closing months of the year under report became abnormal, so much so, that in the last quarter the number of births far exceeded any previous record." The birth-rate of 29·91 per 1,000 of population, recorded for the year, must be considerably lower than the real birth-rate, if the last census figures are used for working out the ratio. For, since the census was taken, the population had decreased by close upon half a million; and, to obtain the true birth-rate, the number of births should be calculated on the reduced population numbers of the year recording the births, and not on the higher population numbers of the census year.

4. The remarkable improvement in the health of the population of the Province may be estimated from a comparison of the *mortality* in the year under review with that recorded in 1897. In the latter year the deaths numbered 658,822, giving a ratio per 1,000 of population of 69·34; in the year under report they numbered 230,907, giving a death-rate of 24·30. In addition to the influence of a return of prosperity upon the public health in reducing the recorded death-rate, there were other causes operating in the same direction. In the case of the deaths, as in the case of the births, the population furnishing them was nearly half a million less than the census population on which the death-rate is calculated. Moreover, during a year of privation and distress the sickly and feeble, the very young and the very old, suffer disproportionately to the robust and those in the prime of life: the former disappear, leaving a population weeded of its weak and sickly members, and consequently with a higher average expectation of life. The low birth-rate of the year, also, doubtless contributed to a lessened mortality. The birth-rate of 29·91, although higher than that recorded in the previous year, was far below the birth-rate recorded for the decennium 1881–90, which was 41·56 per 1,000 of population. As a rule, to which, however, there are exceptions, a high birth-rate accompanies a high death-rate. The enormous death-rate of 400·00 amongst children under one year of age recorded in the previous year fell to 210·58 in the year under review. These figures illustrate the truth of the statement that the tendency to death is proportionately greater amongst the very young than amongst those of riper years; and consequently, that a population containing a high ratio of the very young, or in other words, a population with a high birth-rate, might be expected to record a high death-rate. If the examination by Native Superintendents of Vaccination of the entries of births and deaths in the registers kept by the *kotwars* and police was thorough, its results would afford strong evidence in favour of the accuracy of the registration of vital statistics in the Province. In the 3,989 villages inspected, the *kotwars* had recorded 40,413 births and the police 40,171; whilst the number found by the Native Superintendents was 40,525. One would like to know what method was adopted by the Native Superintendents for checking these entries. The only effectual method is believed to be that of making a house-to-house inquiry, a tedious and laborious proceeding which few have the time and patience to carry out thoroughly. The number of persons convicted for breach of the municipal byelaws, or not reporting births and deaths, during the year was only 184, as compared with 252 in the previous year.

5. *Chief Causes of Mortality.—Cholera*, which carried off 57,131 of the inhabitants of the Province in the previous year, had only seven deaths attributed to it in the year under report. The Central Provinces are thus seen to have shared in the immunity from this disease, which was so marked a feature of the sanitary history of the year throughout India.

6. The first case of *plague* reported in the Province was one introduced from Bombay, which ended fatally on the 31st December, 1896. From that date up to the 15th December of the year under review the total number of cases imported into the Province is stated to have been 19. Notwithstanding the importation of a succession of cases in 1897 and 1898, it was not until October of the latter year that the first indigenous case was detected. "At the end of that month the disease was communicated by a traveller from Bombay to a person residing permanently in Khandwa." Up to the end of the year under review, 125 fatal indigenous cases of plague were recorded.

7. Of *small-pox* deaths there were 926, as compared with 3,641 in the previous year and with 7,747 in 1896. Although there has thus been an abatement of the epidemic, the record of 65 deaths from the disease in December shows that it still lingered in the Province. Of the 926 deaths, 218 occurred amongst children under one year of age. Vaccination made good progress during the year 1898–99, showing an increase in the number of operations by all agencies, for the entire Province, of 50,551 in excess of the number for the previous year. But considerable part of this excess was due to the greater number of revaccinations performed. Notwithstanding that the season's work shows a satisfactory improvement over that of the previous year, and that much of the ground lost during the period of scarcity and famine has been recovered, the figures are still below those of the ante-famine years. But, as the Sanitary Commissioner points out, the decrease of the population during the three years 1896–98 must not be lost sight of in a comparison of the numbers vaccinated during the year under review and the years prior to 1896. This shrinkage of the population, estimated at close upon 650,000, comparing the population numbers for 1898 with those for 1895, would necessarily be attended by a substantial reduction in the number of persons available for vaccination. The percentage of successful cases in primary vaccination was 96·00, and was but slightly less than the percentage for the previous year. The percentage of success, 82·22, in revaccination, is, as usual in this Province, very high; but shows a considerable decrease as compared with that recorded for the previous year. Strict scrutiny would probably have shown that some of the vaccine vesicles returned as "successful" by the vaccinators in revaccination cases deviated more or less from the genuine Jennerian type. If this should not prove to be the case, the high percentage of success might suggest incomplete or imperfect primary vaccination. The use of animal lymph is superseding that of humanised lymph. During the year under report, 270,739 operations were performed with animal lymph. Colonel Scott Reid, who writes the Vaccination Report, says :—"A trial was also made of glycerinated lymph, but the results were unsatisfactory and not in accordance with those alleged to have been obtained in other countries." He adds :—"The virus when issued in this medium (glycerine) appears to be fairly active, but evidently soon deteriorates, probably due to the introduction of other organisms from want of scientific cleanliness in carrying out the method of preparation. I do not recommend a repetition of the experiment, and consider that the present mode of vaccinating direct from the calf is the most effectual yet tried."

8. Of the other chief diseases, *fever*, *dysentery*, and *diarrhœa*, it need only be said that the deaths from the first of them fell from a total, in the previous year, of 389,335 to 155,797, or to less than half; and that the deaths due to the last two diseases fell from 81,092 to 11,722, or to about one-seventh. The remarkable decrease in the mortality from those scourges of the famine-stricken, dysentery and diarrhœa, is a clear indication of the return of more prosperous times.

9. *Sanitary Works.*—Of these, perhaps the most important was the completion of the Jubbulpore waterworks. The total expenditure towards their completion fell but a little short of two and a half lakhs of rupees. Scarcely less important than the water-supply of the city of Jubbulpore is its drainage, now being proceeded with. In Annual Form No. XI., appended to the Report, we find the remark regarding Jubbulpore :—"Underground drains are blocked up and the subsoil water is gradually rising." This rising of the subsoil water is the usual consequence of introducing into a town a water-supply without at the same time providing effectual means of removing it after it has served its uses. Madras and Bombay are examples of the evil effects on the health of the inhabitants of cities, resulting from the incomplete removal of the water introduced into them. Jubbulpore is the second largest city in the Central Provinces, and its death-rate for the exceptionally healthy year under review was 30·23; whilst for the previous five-year period it was 49·89 per thousand of its population. Minor sanitary improvements effected during the year in other municipal towns of the Province are noted in Section IX. of the Report. After a series of disastrous seasons, it was not to be expected that funds would be available for the prosecution of sanitary works on an extensive scale.

10. No new villages were brought under the provisions of the *Village Sanitation Act* during the year. The list of those to which the Act has been extended is not a long one, but short as it is, there are not a few villages, such, for example, as the nine in the Jubbulpore district, in which "no steps appear to have been taken to enforce the provisions of the Act." As an illustration of the difficulties and dangers which the sanitary reformer has to face when he endeavours to introduce improvements amongst the people of India, some facts, gleaned from the Report by the Deputy Commissioner of Chanda, are not without interest. Referring to the two villages under the Act in his district, he remarks that :—"Like the villages under the Mukaddam rules, he found that in these villages, also, the well-to-do were utilising the services of the Conservancy staff, which is provided from the general funds, for clearing their own private latrines." Needless to say, this practice was at once stopped by the Deputy Commissioner; but its existence may be taken to offer some indication of the sense of their duty towards their poorer neighbours occasionally entertained by the well-to-do in Indian villages. Of the Sanitary Board, the Chief Commissioner remarks that it met as usual during the year, but that the work done by it was of necessity much restricted. "In 1898 both money and labour were scarce." The preparation of sanitary maps and the formation of sanitary circles are engaging attention. The Chief Commissioner observes with regret that virtually nothing had been done towards writing up the Village Note books prescribed by the Government of India; but he desires that the matter may receive attention during the approaching cold weather.

11. *Summary.*—The sanitary history of the year furnishes an example of the remarkable powers of recuperation possessed by the Province from the disastrous effects of famine and pestilence. The birth-rate of the latter months of 1898 was almost double the rate for the corresponding months of its predecessor, showing that the cessation of hard times towards the end of 1897, and the return of prosperity, exercised an immediate stimulus on the fecundity of the people. The death-rate diminished to about one-third of that recorded for the previous year. Cholera was practically absent. Plague, although repeatedly imported into the Province, failed to obtain a footing among the indigenous population until towards the end of the year. The epidemic of small-pox, which had carried off many thousands of the inhabitants during the three previous years, greatly abated, and a total of only 926 deaths from the disease was recorded. Vaccination recovered much of the ground which it had lost during the previous years of famine and distress; but the numbers vaccinated were still below those recorded in the ante-famine years. Animal lymph is being largely substituted for humanised lymph; and the Sanitary Commissioner is of opinion that the former is best used direct from the calf. The experience of the use of calf lymph mixed with glycerine as a preservative has not been favourable. The number of fever deaths recorded was only 155,797, as compared with 389,335 in the previous year; whilst those scourges of the famine-stricken, dysentery and diarrhœa, had attributed to them only 11,722 deaths, as compared with 81,092 in the preceding year. The depletion of the resources of the Province by the vast expenditure incurred in famine relief, retarded the prosecution of sanitary works on an extensive scale. The most important sanitary work of the year was the completion of the Jubbulpore waterworks. Little substantial progress was made in the working of the Village Sanitation Act during the year. The Chief Commissioner notes with regret that virtually nothing was done towards writing up the prescribed Village Note Books.

30th June, 1900.

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1898.

Unlike 1897, which was a year of exceptionally great sickness and mortality, the year under review was one of average healthiness. From the summary given of the main meteorological features of the year in the districts for which *data* are available, it appears that in two of them, Cachar and Goalpara, the temperature of the year did not much deviate from normal; whilst in the third district, that of Sibsagar, it was much higher than usual. In all three districts, but to a different degree in each, the rainfall was short of the average. Whilst in Cachar barely half the average fell, and in Sibsagar 12 per cent. less than the average, in Goalpara the fall was only a little below normal. In two of the three districts food was cheap and in the third cheaper than in the previous year, but still dear. The difference in the price of food grains in the different districts was great. Whilst rice sold for 9 seers and 9 chittacks per rupee in Cachar, it sold for 12 seers and 14 chittacks in Goalpara; and whilst only 8 seers and 14 chittacks of wheat could be bought for a rupee in the former district, 15 seers and 11 chittacks could be bought for the same sum in the latter. Such differences in the price of food grains in the same province seem to point to difficulties and cost of transport. In Cachar, with a rainfall of barely half the average, and food cheaper than in the previous year, although still dear, the death-rate fell to about half the rate recorded in 1897. In the other two districts of Goalpara and Sibsagar, the one with a rainfall considerably, and the other with a rainfall slightly, below the average, and both with cheap food, the death-rate fell by nearly a fourth in the former and by more than a fourth in the latter.

2. *Registration of Vital Statistics.*—The population of the Province, according to last census figures, is 5,021,084. Births and deaths are registered in the plains districts of the Brahmaputra and Surma Valleys, as well as in certain selected areas in the hilly parts of the Province, including the station of Kohima. Including Kohima and the selected areas in the Garo Hills, the tracts in which registration of vital statistics is not yet in force, have a population, according to last census, of 455,749. Registration is still very backward in most parts of Assam, but more especially so in the districts of the Brahmaputra Valley, where the village headmen are responsible for the record of births and deaths, but receive no remuneration for the performance of this duty. In the districts of the Surma Valley the work of registration is better done. In these districts births and deaths are reported by paid village watchmen. In the Brahmaputra Valley the district of Goalpara is an exception to the rule that registration in the districts of that valley is entrusted to the *gaonburas* or village headmen. In Goalpara the *chaukidars*, or village watchmen, record births and deaths, with the result that the work is more efficiently performed than in any of the other districts. Under this *chaukidari*, or village watchmen system, of collecting and recording vital statistics in other Indian provinces in which it is in force, registration has greatly improved, and now furnishes in many of them figures on which reliable conclusions regarding the influences which affect the public health may be arrived at. Until registration by unpaid *gaonburas* is replaced by the *chaukidari* system, which gives so good results in Goalpara, or some other of equal or greater efficiency, there seems to be little ground for hope that an approximately accurate record of vital statistics will be secured. The Chief Commissioner writes: "Considering that the figures are calculated upon the census of 1891, and that the population, at least of foreigners, has enormously increased since that date, the general result shows that the work of birth registration is very imperfectly performed."

3. It was only to be expected that, immediately following 1897, a year of unprecedent sickness, the year under review would record a low *birth-rate*. From a ratio *per mille* of population of 32·59 it fell to 29·46, and was the lowest recorded in any province in India except Madras, in which latter

registration of vital statistics continues to be very defective. In the district of Goalpara the highest birth-rate in the Province was recorded, and in Nowgong the lowest. In the former this rate was 38·18, and in the latter only 18·66. In Goalpara the higher birth-rate is no doubt partly due to better registration; but the difference in the system of registration would probably not by itself account for the birth-rate of Nowgong falling short of that of Goalpara by more than half. The low birth-rate of Nowgong is no doubt, in part at least, due to the fact that the district "is the home of *Kalá-ázár*, and notoriously the unhealthiest in the Province."

4. The *death-rate* fell from a ratio of 50·61 per thousand of population in the previous year to a ratio of 36·15 in the year under review, but was still the highest recorded in any province of India. Nowgong records the highest death-rate, 47·25. In this instance its vital statistics, however defective they may be, are in agreement with the well-known position which the district occupies as the most unhealthy in the Province. If the registered numbers of births and deaths bear any approximation to the actual numbers, the depopulation of Nowgong must be in course of speedy accomplishment, unless the excess of deaths over births is being made good by the influx of immigrants. During the year under review 16,260 deaths were registered against only 6,421 births. For the Province as a whole the recorded number of deaths exceeded the recorded number of births by 33,638. Whilst the registration of vital statistics is still so imperfect, it would be unsafe to draw conclusions from these figures as to the increase or decrease of the population of the Province; but it is certain that, in the words of the Chief Commissioner, the population, at least of foreigners, has "enormously increased" since last census. Whether there has been an increase of the indigenous population is a question which may receive an answer when the next census is taken. Until the record of vital statistics is effected with some approach to accuracy, many important points bearing on the health and progress of the population of the Province must remain obscure.

5. *General History of the Principal Diseases.*—There was a marked decrease in the mortality from *cholera*. The number of deaths from this cause fell from 33,240 in the previous year to 11,149 in the year under report. The excessive cholera mortality amongst immigrant coolies coming up the Brahmaputra to work on tea gardens shows a remarkable decrease. In 1897 the deaths recorded amongst this class on steamers and at the coolie depôts numbered 1,121; in the year under report the number was 84. But this decrease was, in part at least, due to the circumstance that "the flow of immigration was much less in 1898 than in the two previous years." The Chief Commissioner adds: "But there can be no doubt that this satisfactory decrease in mortality was largely due to the exertions made by the Governments of Bengal and Assam to improve sanitary arrangements in the journey from the recruiting districts." It should not, however, be overlooked that, from whatever cause or causes, the year 1898 was not what may be called a "cholera year" throughout India. The disease was almost everywhere more or less in abeyance. The conditions to which its general decrease was due must also have been general in their nature and incidence. No doubt local sanitary arrangements would, as usual, have their effect in controlling outbreaks of the disease, but over and beyond these, some far-reaching and powerful influence must have been in operation to account for the marked abeyance in which cholera remained during the year throughout India.

6. The mortality from *small-pox* decreased from a ratio of 1·08 in the previous year to a ratio of 1·03 in the year under report. More than half of the small-pox deaths took place in the single district of Nowgong, in which the death-rate from this cause was 8·34 as compared with the provincial rate of 1·03. In his report for 1897, the Sanitary Commissioner, Colonel Stephen, predicted that a severe epidemic of small-pox would probably occur in Nowgong during 1898, in consequence of the unprotected condition of its population, who have a bigoted objection to vaccination. During the vaccination year 1898–99 there was a serious falling-off in the number of vaccine operations. Primary vaccinations decreased from 272,707 to 237,088. In the district of Sylhet, in which the largest decrease is recorded, "this result is attributed to a very severe outbreak of malarial fever in 1897, which caused a lowering of the general stamina of the population and a high rate of mortality amongst children, together with a decrease in the birth-rate in that year." The percentage of success recorded in this Province is, as usual, very high. In primary vaccination, according to Statement No. 1 of the Vaccination Report, the percentage was 98·35, and in revaccination 93·78. Both percentages are high, but that claimed in revaccination cases is incredible, except on the supposition that the protection conferred by the primary vaccination of those subsequently revaccinated was incomplete. Colonel Carr-Calthrop personally inspected a very large number of cases of vaccination during his tours, and, as a result of his observation, is of opinion that the number of cases reported as successful is too high. The officers in the best position to control the records of the vaccinators, and to see that only cases which fulfil all the conditions of genuine vaccination are returned as successful, are the Civil Surgeons. If revaccinations were subjected to the same tests, which have in Berar, for example, reduced the percentage of success to 23·1, it can hardly be believed that a percentage of 93·78 would be attained in Assam. The remarkable success which attends the use of calf lymph mixed with glycerine and water, and stored in capillary glass tubes, has nowhere else been attained in India. In the North-Western Provinces, after remarking that calf lymph in tubes, unmixed with any preservative, has not good keeping qualities in the climate of the North-Western Provinces, the Sanitary Commissioner adds:—"Very thorough supervision and a training in antiseptic methods far in advance of that given to vaccinators are required in the preparation of lymph preserved by admixture." In the Report of the Madras Presidency we read:—"As usual, fresh animal lymph shows the greatest percentage of success, viz., 97·6, then comes vaccine sent out between glass plates without any preservative, then lanoline paste, and lastly glycerine with 95·9, 88·0, and 82·4 respectively." Yet, in Assam, with calf lymph mixed with glycerine and water and issued in capillary glass tubes, the percentage of success recorded in primary vaccination, for the Province as a whole, is 98·35. The Vaccination Departments in other provinces might do well to study the method of supplying calf lymph, which gives so excellent results in Assam. In that Province arm-to-arm vaccination has been practically abandoned everywhere, and calf lymph, prepared and preserved as described, is distributed to the vaccinators of the several districts from a central bovine depôt.

7. Fever, including *Kalá-ázár*, was much less destructive than in the previous year : the death-rate fell from 28·74 per thousand of population to 20·90. In the two districts of the Surma Valley the decrease was especially great. In the Cachar district the fever death-rate in the previous year was 35·30, and in the year under report only 15·34. Accompanying this subsidence of fever mortality in Cachar, "barely half the average rainfall" was recorded in that district during the year under review. Probably there was some intimate, although not clearly understood, connection between the lessened rainfall and the lessened fever mortality. In the opinion of the Sanitary Commissioner, the fatal form of fever known under the name of *Kalá-ázár* appears to be gradually dying away from the Province as a whole. If the disease should follow the same course as that taken by the Bardwan fever epidemic, which it is said closely to resemble, its disappearance from Assam may perhaps take place in somewhat the same manner as the disappearance of the similar, if not identical, type of fever from Bengal. The endeavour to place quinine within reach of the people in remote parts of the Province meets with success. From a record of 2,181 packets, each containing 102 five-grain doses, sold in the previous year, the number has increased to 3,750 packets in the year under report.

Sanitary Works.—"No work of special importance was undertaken," writes the Chief Commissioner, "nor is it likely that in Assam, where the towns are so small, sanitary works of any magnitude will be undertaken for many years to come." But a great number of smaller improvements were made in many places. These improvements in rural areas consisted chiefly of the construction and repair of wells, and the excavation and deepening of tanks. The method of disposal of night-soil by trenching is adopted in all the municipalities except Sylhet ; but one great obstacle to its complete success is the rooted prejudice against the cultivation of the trenching grounds. This prejudice has existed and gradually disappeared in other provinces under the influence of the profits accruing to those who overcome it.

9. *Summary.*—In contrast with its predecessor, which was a year of exceptionally great sickness and mortality, 1898 was ordinarily healthy. The rainfall in the three districts for which records are given was, in one of them, barely half of the average ; and in the other two considerably less in the one and slightly less in the other than the average. Preceded by a season of unusual sickness, the year under review records a birth-rate the lowest of any province in India, except Madras. The births were fewer than the deaths by 33,638. But there is good evidence to show that, owing to defective registration, a considerable proportion of the births annually remains unrecorded. Until the system of registration of vital statistics by unpaid village headmen is replaced by some such system as that in force in the Surma Valley and in one district of the Brahmaputra Valley, it is hopeless to look for much improvement in the record of births and deaths in Assam. The death-rate of the year fell from a ratio per thousand of population of 50·61 in the previous year to 36·15 in the year under review, but was still the highest recorded in any province in India. Cholera deaths were fewer by nearly two-thirds than in the previous year. The decrease in the number of deaths from cholera amongst immigrant coolies was a satisfactory feature of the sanitary history of the year. No doubt the improved sanitary arrangements made in connection with the transport of the coolies from the districts in which they were recruited to the tea gardens in Assam helped to reduce the mortality from cholera ; but it should not be overlooked that 1898 was not what is called a "cholera year," and that general, if little understood, influences appeared to keep the disease in comparative abeyance all over India. Small-pox was less fatal than in 1897. There was a serious falling-off in the work of the Vaccination Department, but remarkable success attended the system of supplying calf-lymph mixed with glycerine and water, and stored in capillary glass tubes. The use of humanised vaccine lymph has practically been abandoned in Assam. The percentage of successful cases in primary vaccination reached the high figure of 98·35, whilst in revaccination the almost incredible percentage of 93·78 is recorded. The Sanitary Commissioner from personal examination of a large number of cases is inclined to think the recorded percentage higher than it should be. Fever, including that specific form of it known as *Kalá-ázár*, appears, the Sanitary Commissioner thinks, to be gradually dying away in the Province. No work of special sanitary importance was undertaken during the year.

25th May, 1900.

No. 8.

Memorandum by the Army Sanitary Commission on the Medical and Sanitary Report of Coorg for 1898.

The total rainfall for the year measured 109·35 inches, as compared with 134·04 in the previous year. The largest amount of rain fell, as usual, in June, July, and August. The price of the staple food-grains, common rice, and *ragi*, but especially the latter, was higher than the average of the quinquennial period 1893–97. The mortality of the year exceeded that of any other prior to 1897—the most unhealthy year on record.

2. *Vital Statistics.*—Following a very unhealthy year, it was only to be expected that 1898 would show a low *birth-rate*. The number of births registered fell from 3,503 in the previous year to 2,795, and only slightly exceeded half the number of deaths. In Coorg, the number of births is generally less than the number of deaths, a peculiarity which has frequently been explained to be largely due to the constitution of the population. To the extent of upwards of a fourth of its total the population is

made up of coolies from Mysore, who annually enter the Province without their families to work on the coffee estates. An additional cause is also, no doubt, the imperfect registration of vital statistics. In a hilly country like Coorg, with a scattered population, the improvement of registration will be no easy matter. The Civil Surgeon suggests that the report of births might be encouraged by the giving of a small reward to the person making the report; but the Commissioner is probably right in believing that, if the reward were "worth having at all," it might lead to the making of false reports to obtain it. Even were it desirable to introduce compulsory registration, the necessary village agencies for carrying it into effect are said not to be available.

3. The *death-rate* of 31·44 per 1,000 of the population was nearly the same as the mean of 31·07 for the previous five years; this mean being, however, abnormally high owing to the excessive death-rate of 50·03 recorded in 1897. An examination of the mortality records according to age will show that, in Coorg, instead of the number of deaths amongst children under one year of age being, as in other provinces, greater than the number recorded for any of the subsequent age groups, it is largely exceeded by the number of deaths amongst adults between 20 and 30 and between 30 and 40. The high death-rate amongst the groups aged from 20 to 30 and from 30 to 40 seems to confirm the truth of the observations recorded from year to year regarding the abnormal mortality amongst the coolies who enter the Province in quest of work. The same table shows that, according to sex, the deaths of males over 20 and under 50 exceed in number those of females of the same ages. Between the ages of 20 and 30 the number of males who died was 546, as compared with 397 females of the same age; and between the ages of 30 and 40 the deaths of males numbered 574 to 324 of females. These figures seem also to support the statement that many of the coolies who annually enter Coorg do not bring their families with them.

4. *Chief Diseases.*—Only eight deaths were attributed to *cholera* during the year, as compared with 106 in 1897. At the same time, the number of deaths from *small-pox* decreased from 59 in the former year to 22 in the year under review. In Coorg, as in other provinces threatened with, or attacked by plague, vaccination work suffered much from the suspicion that got about among the people that it was in some way connected with plague inoculation. So serious was the excitement among the people, owing to this groundless suspicion, that it was considered expedient to discontinue vaccination operations from November, 1898, until the following March. Needless to say that, as a consequence, the numbers vaccinated during the year show a large decrease. Whereas those vaccinated by the regular establishment in 1897–98 numbered 10,616, in the year under review they numbered only 5,283, or less than half. In addition, however, to these, 390 vaccine operations were performed at dispensaries by medical subordinates. The percentage of successful cases recorded in primary vaccination was 93·15, and in revaccination 80·93. The latter ratio of success is so high as to suggest either defective primary vaccination or the return of all cases as "successful" which showed any sign of local irritation following the operation. In Calcutta, the ratio per cent. of success attained in revaccination, during the same year, was 23·68 of the cases regarding which the results were ascertained. The extraordinary variations in the recorded ratio of success in revaccination in the different provinces of India seem to be incapable of explanation, except on the assumption that there is a wide difference of opinion amongst vaccinators as to what constitutes a successful revaccination. Calculated on the census population of the Province, 29·46 *per mille* were protected against small-pox during the year by vaccination, as compared with 59·51 in the previous year.

5. *Fevers*, as usual, were credited with having caused the great majority of the deaths. The number of deaths registered under this head was 4,676, as compared with 7,182 in the previous year, or a ratio *per mille* of population of 27·02, as compared with 41·50. The ratio was, however, higher than the mean for the previous five years, which was 25·06.

6. Fortunately, *plague* did not succeed in effecting an entrance into Coorg, although it prevailed in the adjoining districts of Mysore. How much of the immunity which Coorg enjoyed from infection was due to the measures taken to examine all persons entering the Province from infected localities cannot be exactly determined. The Chief Commissioner seems to attribute some share in the fortunate result to the fact that plague measures of a drastic nature were not enforced in Mysore city when this was seriously affected, and to the consequent absence of the panic and the dispersion of the inhabitants which elsewhere followed attempts to arrest the spread of the disease by forcible measures of segregation and disinfection. The absence of communication by rail with Mysore territory, the Chief Commissioner thinks, may also have contributed to safeguard the Province from plague invasion. Efforts at prevention were not limited to the defence of the frontiers by the establishment of observation camps with police and medical staffs for the examination of visitors from outside. "The planters, both European and Natives, were fully alive to the importance of preventing the plague getting hold on the Province. They almost all had their lines white-washed, well cleaned up, and their sanitation generally attended to." It is satisfactory to learn that the authorities, whilst watching the frontiers of the Province, do not neglect measures calculated to prevent plague obtaining a foothold should it succeed in getting through the outer defences. Against the probable introduction of plague, the President of the Sanitary Board said that, "dependant as Coorg is for its supplies from Mysore, the only measures were strict attention to the sanitation of towns, villages, and estates, and the strengthening of the Medical Inspection Staff."

7. *Summary.*—The year, judged by its record of deaths, was less unhealthy than its predecessor. The mortality from all the principal diseases showed a decrease. Immediately following an exceptionally unhealthy year, 1898 records, as was only to be expected, a low birth-rate. For reasons repeatedly explained, the birth-rate of Coorg is generally lower than the death-rate, and in the year under review was about half of the latter. Neither cholera nor small-pox prevailed in epidemic form. The work of the Vaccination Department suffered from the plague-inoculation panic, and had to be stopped for several months until the public excitement subsided. The numbers vaccinated

decreased by about half, as compared with the numbers vaccinated during the previous year. Although plague prevailed in the adjoining districts and town of Mysore, it fortunately failed to effect an entrance into Coorg. This result may to some extent have been due to the vigilance of those in charge of the observation camps established on the frontiers of the Province. The Chief Commissioner thinks the immunity enjoyed by Coorg may have been, in part, due to the absence of forcible plague measures in the city of Mysore, and to there being no communication by railway between Coorg and plague-infected areas.

25th May, 1900.

No. 9.

Memorandum by the Army Sanitary Commission on the Rajputana Sanitary, Vaccination, Dispensary, and Jail Report for 1898.

The year was a comparatively healthy one. The rainfall was deficient in the Ajmer-Merwara Division as well as in most other parts of Rajputana, and the crops suffered ; but owing to facilities for import from more fortunate provinces the prices of food grains varied little from normal. If the deficiency of the rainfall may be taken as any measure of the extent to which the season's harvests suffered, the year must have been a calamitous one to the people dependent for their livelihood on agriculture. Whilst in Ajmer 23·29 inches of rain fell in 1879, and the average fall for the previous six years was 25·80, the total fall during the year under review was only 12·97, or about half. In Beawar the number of inches of rain measured was much the same as in Ajmer, and was 9·97 inches below the average. Besides the injury to the crops, the deficient rainfall caused a scarcity of the water-supply in most of the States of Rajputana. The influence of these conditions on the public health seems to have been what might have been anticipated ; the mortality from fevers was much less than in the previous year, and the mortality from dysentery and diarrhœa considerably greater. The exceptional dryness of the year was accompanied by lessened prevalence of malarial fevers ; and the scarcity of water, synonymous as a rule with its greater impurity, tended to increase the mortality from bowel complaints.

2. As in former years, the only part of Rajputana from which vital statistics are obtained which have any valid claim to be considered approximately accurate, is the Division of Ajmer-Marwara with its population of 542,358. Registration in the Native States of Rajputana, with their population computed at a total of from eleven to twelve millions, is still, in most of them, very defective, and in one at least is not even attempted. This need not be wondered at, if account is taken of the prevailing ignorance of the value of vital statistics, and the suspicion with which the registration of births and deaths is still regarded in many of the States. If the policy is persevered in of "constantly although cautiously" endeavouring to improve the system of collecting statistics, it is only a question of time, though possibly of a long time, until the statistics of the Native States are brought into line with those of the Ajmer-Merwara Division.

3. The *birth-rate* recorded in Ajmer-Merwara fell from a ratio per 1,000 of population in the previous year of 33·69 to 29·73. When this rate, itself no doubt considerably below the actual rate, is compared with that recorded in the Native States, some estimate may be formed of what remains to be done in the latter before the record of their vital statistics can be safely used as data from which to draw conclusions regarding the public health. "The average birth-rate registered in all the States which furnish returns was 13·64 *per mille* of population, and the death-rate 12·34." The record of births of male children is less defective in these States than of female children, many of the people being "still averse to reporting female births, which, according to their ideas, reflect discredit on the family and household."

4. The *death-rate* in Ajmer-Merwara shows a considerable decrease as compared with that for 1897. In the year under report it was 22·13 per 1,000 of population, and in the previous year 24·68. The decreased death-rate of the year was chiefly due to less mortality from fever. From some of the other principal diseases, such as small-pox, dysentery, and diarrhœa, there was a considerably higher death-rate than in the previous year. In the Native States, on the other hand, taking the returns for what they are worth, a decrease and not an increase in the mortality from small-pox, dysentery, and diarrhœa, as well as from fever, was recorded.

5. In Rajputana, as throughout India generally, 1898 was what the Administrative Medical Officer terms a "non-cholera" year. Only a single death suspected to be due to *cholera* occurred in the Ajmer-Merwara Division. In the Native States, also, the disease was practically absent. The six deaths said to have been caused by it in the Bharatpur State are considered by the Administrative Medical Officer to have been due to some local insanitary condition or poison, and not to true cholera. Other 14 fatal cases were reported from Bundi ; but as registration has only been attempted for the first time in that State in the year under review, much reliance need not be placed on the accuracy of the report. The unusual immunity from cholera enjoyed by India during the year 1898 is remarkable, and, as we have observed in other memoranda, was probably due to some general cause or causes affecting the whole county. In the preceding year the deaths attributed to cholera in Rajputana numbered 1,514.

6. *Small-pox* was nearly three times more fatal in the Ajmer-Merwara Division during the year under report than in the previous year, the number of deaths having increased to 409 from 158. Vaccination, both in the Ajmer-Merwara Division and in the Native States, made good progress during the official year 1898–99. In previous memoranda we commented on the remarkably high record of

successful cases recorded in some of the Native States, and expressed some doubt as to the percentages being the genuine outcome of the ordinary vaccinator's operations. In the report under review it is stated, with reference to our remarks, that "the Administrative Medical Officer gave considerable attention to the high percentage of vaccination, and he has no reason to suspect irregularities." Taking as an example of the ratios of success recorded by some of the Native States, the ratio claimed by Kishnagarh, it is noted that, of the 2,607 cases of primary vaccination, 99·96 were successful, notwithstanding that Kishnagarh is one of the States described as "still very backward" in respect of vaccination. This backwardness must refer to the quantity, and not to the quality of the work. It is but fair, however, to state that the result of the examination of a large number of cases by Residency and Agency Surgeons, appears to support the Adminstrative Medical Officer's belief in the accuracy of the ratio of success claimed by the vaccinators.

7. The steps taken to keep *bubonic plague* from establishing a footing in Rajputana had, up to the end of the year, proved successful. So far, no indigenous cases had followed the entrance of imported cases; but the experience gained in other provinces does not favour a confident belief that this preliminary success will be followed by the permanent exclusion of the disease from a country, the borders of which are described as being "much exposed to an invasion of plague."

8. The record of sanitary defects and improvements shows that progress is being made in sanitation throughout most parts of Rajputana. The city of Jaipur, with a population of 158,905, sets an example to the other towns of the Province. In this exceptionally advanced city the water supply is described as being "sufficient and good." The latrine system has been improved during the year, and the conservancy system is working satisfactorily. Village sanitation is likewise beginning to receive some attention in most places; but until the villagers have become more enlightened, and have learnt at least such elementary lessons as the need for drinking pure water and breathing pure air if health and comfort are to be enjoyed, it may be wise to insist on the enforcement of no more energetic measures of sanitary improvement than those described in paragraph 64 of the Report. "Residency and Agency Surgeons have been encouraged to spend as much of the cold weather as possible in camp, where they have had opportunities of advising sanitary authorities in the sanitary measures which could be easily carried out. With the exercise of tact, patience, and judgment on the part of the medical officer the people can be prevailed upon to protect their water-supply, and do much to improve the sanitary condition of their surroundings, which would not easily be accomplished by Durbar orders."

9. In both Ajmer-Merwara and in the Native States the numbers of both indoor and outdoor patients treated at dispensaries show a considerable decrease as compared with the numbers for the previous year. This is only equivalent to saying that the year under review was healthier than its predecessor. The usual dryness of the year was accompanied by a marked decrease in the number of patients treated for fever and spleen affections. In keeping with these conditions there was a falling-off in the sales of quinine. The number of surgical operations, however, shows an increase from 62,004 in 1897 to 64,489 in the year under review.

10. The death-rate in the Ajmer jail rose from a ratio of 6·84 per 1,000 of jail population to 13·90; but even the latter rate cannot be considered a high one. The increased mortality is attributed to the fact that a comparatively large number of the convicts were old and in indifferent health at the time of admission. In the 20 jails in Native States from which returns were received, there was a marked decrease in the number of the admissions into hospital more especially, but likewise a decrease in the daily average number of sick as well as in the death-rate. This last fell from a ratio of 23·58 per 1,000 in the preceding year to 19·23. It is thus evident that the healthiness of the year had a marked effect in reducing the ratios of sickness and mortality among the prisoners as among the free population. Improvement in the management of the jails, no doubt, also contributed its share to the improvement of the health of the prisoners. Regarding two of the most unhealthy jails in the Native States the Agent to the Governor-General writes:—"The state of the existing jail at Banswara, like that at Dholpore, demands and has received close attention."

11. *Summary.*—The year was a healthy one. The deficient rainfall was unfavourable to the crops, but was accompanied by diminished fever prevalence and mortality. Except in the Ajmer-Merwara Division, the registration of vital statistics continues very backward. In many of the Native States no dependence can be placed on the ratios of births and deaths recorded. The ignorance of the people and the suspicion with which they regard the registration, more especially of births, will take time and patience to overcome; but constant though cautious endeavours are being made to improve the system of collecting vital statistics. Needless to say, the ratios of 13·64 births and of 12·34 deaths per 1,000 of the population of the Native States, recorded for the year under review, probably represent less than half the actual ratios. In Rajputana, as in the other provinces of India, cholera was in abeyance. The few deaths attributed to the disease, the Administrative Medical Officer thinks, may not have been due to true cholera. Small-pox was three times more fatal in the Ajmer-Merwara Division than in the previous year. Vaccination made satisfactory progress. The usual phenomenally high percentages of success claimed by the vaccinators of the Native States continue to be recorded; but the Administrative Medical Officer, who has given attention to this matter, says he has no reason to suspect that they are due to irregularities. Although several cases of bubonic plague were imported into Rajputana, no indigenous case of the disease occurred up to the end of the year. Substantial progress in sanitation is being made in most parts of Rajputana. The attendance of patients at dispensaries fell off during the year, which is equivalent to saying that the year was healthier than its predecessor. The health of the prisoners, like that of the free population, was better than in 1897.

25th May, 1900.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1898.

The Report of the Sanitary Board, which precedes that of the Sanitary Commissioner, gives brief details in an Appendix of the Municipal and Local Funds works, with their plans and estimates, dealt with by the Board during the year. The total estimated value of these works falls somewhat short of five lakhs of rupees. The type designs being prepared and issued by the Board for such buildings as slaughter-houses, vaccine depôts, latrines, &c., should prove useful guides to municipal and local bodies. Anyone may see that much money has hitherto been spent in India on buildings defective in principle and ill-adapted for their purpose, because the needful expert sanitary and engineering knowledge may not have been available, or was not taken advantage of, when the buildings were being designed. The example set by the Madras Board, of issuing type designs of buildings of the nature mentioned in paragraph 18 of its Report, might be usefully followed in other provinces in which the Municipalities and District Boards may not already be in possession of such designs.

2. The year under review was favoured by a generally satisfactory rainfall. Whilst the quantity of rain registered during the south-west monsoon, 25·70 inches, was almost up to the decennial average of 25·84, the fall during the north-east monsoon was 6·13 inches in excess of the decennial average of 14·94 inches. Yet, the prices of food grains fell little below those which ruled during the previous year of scarcity or famine, and were greatly above the prices of 1896, as well as the average of the 10 years ending with 1895. In the case of the staple grain, *ragi*, there was no fall whatever. A glance at the table at the end of paragraph 2 of the Report, shows a general, though somewhat irregular, rise of prices since 1883. The Sanitary Commissioner, whilst considering that it would be going beyond the scope of his report to enter into the various factors which have brought about this rise in the price of food-grains, thinks that, notwithstanding the adverse effect of the rise on certain sections of the community, "for the majority it implies a wave of prosperity, that will, in due time, bear with it in its advance the temporarily suffering minority." Amongst the indications which lead him to form this hopeful forecast, he mentions the decided tendency to increase of wages of the lower classes, and no diminution of the area under cultivation, no excess of emigration, great increase of capabilities of interchange of products by rail and sea, the general accession of manufactories of raw products, and increasing exports of seeds and grains. One factor likely to influence prices of food-grains is the ever increasing pressure of population. There may be no diminution of the area under cultivation, but unless there is, on the contrary, a very large expansion, the increase of the population of the Presidency since the census was taken in 1891 by over two millions, comparing the census with the estimated figures, can hardly fail to exercise a decided effect on food prices. The population according to last census was 35,641,828 : it is now estimated to be 37,715,417.

3. The *birth-rate*, estimated upon the last census figures, was 27·4 per thousand of the population, as compared with 28·7 in the preceding year. This decrease is attributed by the Sanitary Commissioner, partly to the influence on fecundity of the famine conditions which prevailed in several districts during 1896–97, partly to marriages having been deferred as far as possible during the past three years in consequence of the expectation of "evil times" by the native population, and to imperfect registration. In some of the districts, registration of vital statistics continues to be very defective. In the districts of Malabar, with its population of over two and a half millions, the birth-rate recorded is only 18·6 per thousand of population, in Madura 22·7, and in Ganjam 22·9. In other words, approximately half the number of births probably remained unregistered in these districts. In municipalities the birth-rate was 34·9, as compared with 34·4 of the previous year. Obviously, registration of births is effected with much greater completeness in municipal towns than in rural areas.

4. The *death-rate* decreased from 25·4 in the previous year to 21·0 in the year under review. In some districts, such for example, as Ganjam and Malabar, the decrease was very great. In the former district a death-rate of 50·1 was recorded in the previous year and of only 22·1 in the year under report. This remarkable decrease was in considerable part due to the abatement of the violent epidemic of cholera, by which the district was ravaged in 1897. Whilst in that year cholera was credited with a death-rate of 12·5 per thousand of its inhabitants, the disease has practically disappeared in 1898, having recorded against it only 0·04. Small-pox was likewise very fatal in the former year, when it was responsible for a death-rate of 1·7; but, unlike cholera, it still continued to be the cause of great mortality in the year under report. In this latter, the recorded death-rate was 8·5. In addition to the decrease in mortality from these two diseases in Ganjam, the fever death-rate fell from 19·9 in 1897 to 11·3 in 1898. As regards Malabar, the decrease was due mainly to lessened mortality from cholera, the death-rate from which fell from 9·9 to 0·4. As in the case of births so in the case of deaths registration is carried out with a greater approach to accuracy in municipalities than in rural towns and villages. The average for municipalities was 31·9 *per mille* of their population, as compared with 19·0 recorded in rural towns. In some of these latter, such as Samalkot, Paramagudi, and Sendamangalam, towns of over 10,000 inhabitants, incredible rates are recorded. In the first-mentioned town the death-rate given is 8·1; and in the other two 9·2 and 9·8 respectively. In certain municipal towns, such, for example, as Dindigul and Bimlipatam, death-rates of under 20 *per mille* are recorded; showing that, even in these, registration is still far from being satisfactory.

5. *Chief Diseases.*—Although *cholera* was credited with less than half the number of deaths recorded against it in the previous year, the mortality caused by it was still high in the Presidency as a whole, and in certain districts excessive. During the year, 65,444 cholera deaths were registered,

giving a death-rate of 2 *per mille* of the population, as compared with 4·4 in the previous year, and with a decennial average of 2·1. The districts of Tanjore, Trichinopoly, and South Arcot suffered severely. The first of these records a death-rate from cholera of 6·7 and the other two 5·5 and 5·2 respectively. These districts "offer good facilities for the transmission of the cholera microbe from village to village by means of lengthy channels that are liable to contamination by reason of the insanitary habits of the people." It would have given more weight to this view of the transmission of cholera by means of a microbe had it been supported by statistics showing that the opening of those channels marked the commencement, in the tracts which they traverse, of a period of increase in the prevalence of cholera as compared with the period preceding their opening. If such statistics can be procured they would be of much interest and value. The fear is that, owing to the defective state of registration, they might not only be unreliable but misleading. Regarding the two municipalities which show the highest cholera death-rates, Palni and Nellore, the former recording a rate of 14·4 and the latter of 10·2 per thousand of population, it is stated that "the drinking water of Palni is subject to pollution"; whilst no remark is made about the water-supply of Nellore, except that two wells and four tanks were repaired." Neither of the towns is in one of the districts mentioned as being "the great irrigation centres of the Presidency." The large town of Trichinopoly has a pipe water-supply, although it is stated that a portion of the town is still supplied by the river Cauvery and its channels. The cholera death-rate in Trichinopoly was 7·3 *per mille*. The rural town which gives the highest cholera death-rate, 24·5, is, like Palni, in the Madura district. The Sanitary Commissioner shows by a table, in paragraph 32, that "had the populations of the 24 towns under the Cholera Rules for combating the disease been attacked at the same rate as those not subject to them they would have lost, during 1895 to 1898, 2,964 more lives than they actually did." Unfortunately, the utility of these rules is often greatly lessened by the inefficient way in which they are applied in municipalities; and the Government has drawn the attention of all collectors to the remarks of the Sanitary Commissioner on this point.

6. *Small-pox* caused 20,490 deaths, equal to a rate *per mille* on the census population of 0·6. The rate for the previous year was 0·7. In the district of Ganjam, which last year contributed more than two-thirds of the total number of small-pox deaths in the Presidency, the disease was again very fatal. Table No. XI. of the Appendix to the Report, which gives the deaths in districts exclusive of towns, shows that of a total of 19,699 deaths from small-pox in the 21 rural districts of the Presidency, Ganjam was responsible for 10,838, or considerably more than half. There were many difficulties in the way of effectually protecting the inhabitants of Ganjam against small-pox by means of vaccination: according to the Sanitary Commissioner, that district "presents a most unpromising field to the sanitarian." In none of the other districts can small-pox be considered to have been very fatal. During the official vaccination year 1898-99, the number of cases of primary vaccination shows a decrease of 149,433 and of 4,303 re-vaccination cases. The cause of so large a falling-off is said to be "probably mainly due to a widespread plague-inoculation scare." Among other reasons given to account for the decrease are the failure of the lymph supply in certain districts and absence on leave of vaccinators without substitutes. The first of the causes assigned was probably altogether beyond the control of the Vaccination Department; but for the provision of an adequate supply of good vaccine lymph and the maintenance of the staff at its full strength one would have expected the Department to be competent to make satisfactory arrangements. Accompanying this decrease in the amount of work there was a distinct fall in the percentage of successful cases. From 92·5 and 92·0 in the two previous years, this percentage fell, in the year under review to 89·5. A table is given in paragraph 8, showing the percentage of children under one year of age protected in proportion to the number of births. In districts, exclusive of municipalities, the highest percentage recorded was 66·8 in Madura; and the lowest 2·1 in Malabar. In many municipalities the number of children under one year of age who were vaccinated, considerably exceeded the recorded number of births. The municipality of Madura gives the highest percentage of 124·7, and that of Cuddapah the lowest percentage, 27·7. The explanation of the excess in the number of children vaccinated over and above the recorded number of births is doubtless to be found in defective registration of vital statistics, as has been suggested in the Government review of the vaccination report. The use of vaccine lymph taken from human beings has been discontinued entirely in Madras. "As in the previous year, all the operations were performed with animal lymph." As might have been expected, calf-to-arm vaccination gave by far the best results: 92 per cent. of the cases proved successful. Lymph preserved with glycerine gave the worst results, returning only 82·8 per cent. of successful cases. There is, however, an exception to this general experience. In the hands of the dispensary staffs and medical subordinates the results, as recorded in the table on page 17 of the Report, show that lymph "direct from the calf" proved successful in only 73·6 of the cases; and "glycerine paste" in 80·1 per cent. These results are so unusual that some inquiry might be made as to the mode by which the operators succeeded in bringing them about.

7. *Fever* mortality decreased considerably during the year under report as compared with the previous year. The death-rate from this cause fell from 9·0 to 7·5 *per mille* of population. The decrease was chiefly marked in districts that in 1897 had been affected with famine. "From this may be argued better nutrition and better resisting power to malaria of the people of these districts." The Sanitary Commissioner in paragraph 38, as the results of a careful inquiry, shows very clearly that in the town of Madras the returns were ingeniously manipulated during the prevalence of cholera and plague. When the former disease prevailed, there was increased registration under the head of "fever." The object of this was doubtless to prevent the troublesome inquiries which follow the occurrence of cases of cholera, and the extra work thrown on those who are obliged to make special and immediate report on the appearance of each case. Similarly, on the occurrence of plague in Mysore territory and the consequent exercise of greater vigilance on the part of the municipal sanitary staff as to "fevers," the number of cases of the latter fell off, whilst the number of deaths referred to "other causes" largely increased. Ordinarily, when a death is reported as having been caused by "fever," no further inquiry is considered necessary, and no further trouble given to the reporting agents; but fever being a prominent symptom in plague, when the latter disease appeared, all cases of fever were subjected to a strict scrutiny, with, for result, a diminution in the number of

cases registered under the head of "fever" and an increase under the head of "other diseases." By this easily-effected alteration, the registering agents no doubt trusted to be able to save themselves from the troublesome inquiries which, during the prevalence of plague, would follow the report of fever cases.

8. *Dysentery and Diarrhœa*, like fever, and probably from the same cause, the better nutrition of the people, were less fatal than in 1897, the death-rate attributed to them falling from 1·2 to 0·9 *per mille* of population. There can be little doubt that the mortality from these diseases in Madras, as elsewhere, is much understated, many of the deaths due to them being recorded under the head of "fever."

9. *Plague* was imported during the year into 96 localities in a total of 11 districts, including Madras; but in only 20 localities in five districts was it reported as indigenous. The observation of passengers arriving from plague-infected tracts, which commenced in 1897, was kept up during the year under review, and, in addition, a system of inspection of passengers arriving by road was established on the frontiers of several districts. Anti-plague inoculation was practised in accordance with M. Haffkine's method. It is stated that 5,685 inoculations were performed in the Madras town and 10,532 in the Presidency generally. One untoward consequence of these inoculations was the confusion of them by the people with vaccination. This resulted in what has already been referred to as a plague-inoculation scare, followed by a serious decrease in the number of vaccination operations performed during the year. "The result," writes the Sanitary Commissioner, "must be, in the end, a greater loss of lives by small-pox than can have been saved by anti-plague inoculation." In Madras, "evacuation of indigenously affected areas has been found, as in all epidemics of this disease that history has recorded, the best sanitary measure."

10. *Sanitary Works.*—The extension of the waterworks at Conjeeveram, at an estimated outlay of about half a lakh of rupees, was undertaken during the year. Four surveys in connection with water-supply were completed, and one drainage and five water-supply schemes were prepared and submitted either to the Sanitary Board or to Government. It can hardly be said that the list of important sanitary works of a permanent nature undertaken during the year is a long one. Want of the needful funds no doubt, as usual, restricted the number of such works. "Even the sanguine sanitarian," writes Colonel King, "finds at last that it is hopeless reporting to bodies that have no funds to bestow on the improvements he indicates."

11. *Summary.*—The year's rainfall was favourable. As a result there was some decrease in the price of staple food grains, except of *ragi*, which remained the same as in the previous famine year. The Sanitary Commissioner takes a sanguine view of the effect on the population of the continued rise in the price of food grains which has been going on for many years past, and gives his reasons for believing that it implies for the majority "a wave of prosperity that will in due time bear with it in its advance the temporarily suffering minority." A birth-rate of 27·4 was recorded, against 28·7 for the previous year. The decrease is attributed partly to the influence on fecundity of the famine conditions which prevailed in some districts during 1896–97, and partly to marriages having been deferred under the expectation of "evil times" in the near future. The death-rate decreased from 25·4 in the previous year to 21·0 *per mille* of the last census population. This decrease was, doubtless, largely due to the return of prosperity, better and more abundant food, and consequent increased resistance to disease. Registration of vital statistics continues, especially in rural areas, to be very defective; in municipalities it is much better, although still imperfectly carried out. Cholera was credited with a death-rate of 2 *per mille* of population, as compared with 4·4 in the previous year. In some districts the cholera death-rate was more than double the provincial rate, and in two municipal towns rates of 10·2 and 14·4 were recorded. Small-pox caused over 20,000 deaths, more than half of which took place in the single district of Ganjam. There was a large falling off in the number of vaccine operations, due mainly, it is stated, to a widespread plague-inoculation scare. Other causes also unfavourably influenced the season's work. Of these the most important were inadequate supply of good vaccine lymph, and absence on leave of vaccinators without the appointment of substitutes to fill their vacant places. All vaccine operations in the Presidency were performed with animal lymph. As was to be expected, fever and bowel complaints were less fatal than during the preceding year of scarcity and famine. Plague found entrance during the year into 96 localities in a total of 11 districts, but in only 20 localities of five districts was it reported as indigenous. In Madras, as everywhere else, "evacuation of indigenously affected areas has been found, as in all epidemics of this disease that history has recorded, the best sanitary measure." Sanitary works were carried out as far as the limited funds available would permit.

25th May, 1900.

No. 11.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1898.

The year under review was, in its main meteorological features, somewhat like its predecessor. The rainfall was not so heavy, but was up to the average and fairly uniformly distributed. Table A, on pages 31 and 32 of the Report, shows that, in the six districts selected as representing the Presidency generally, there was a marked fall in the prices of food grains as compared with the prices which ruled in 1897. In the case of the millets *juari* and *bajri* the fall was very great. The latter seems to be a staple food grain in all of the six representative collectorates; and its price was, in five

of them, only about half, or less than half, the price at which it sold in the previous year. In Belgaum the fall was not so great : 19 seers were sold for one rupee in 1897 as compared with 16 seers in 1898. The staple food grain *ragi* fell in price only from 16 to 18 seers per rupee. The fall in the price of wheat and rice was also considerable, although not to the same extent as the fall in price of the greater and lesser millets This cheapening of the staple food grains of the people produced a very decided improvement in the public health, as reflected in the marked decrease in the death-rate compared with that recorded during the previous year of scarcity or famine. The birth-rate having, of course, been largely influenced by the unfavourable conditions prevailing during the previous year, reflects to some extent, as was to be expected, those conditions, and, instead of an increase, shows a decrease.

2. The small European and Eurasian populations of the Presidency, numbering respectively, according to last census, 18,486 of the former and 8,519 of the latter, return approximately the same birth-rates as during the previous year, and considerably lower death-rates. Of the Europeans, 13 died of plague in Bombay city as compared with 20 in 1897, and one died of the same disease in Poona. Of the Eurasians, 22 died of plague in Bombay city and one in Poona, as compared with a total of 44 deaths from this cause in the preceding year. There was no death in the year under report in either community from cholera or small-pox.

3. For the Native population the *birth-rate*, which was 33·46 in the previous year, fell to 30·94 in the year under report, and was 5·1 below the mean for the ten years ending 1897. An examination of the monthly record of births shows that, during each of the first seven months of the year, the number of children born fell far below the number born in the corresponding month of the preceding year, and also of the mean for those months during the ten-year period 1888–97. On the other hand, the number born during each of the last five months was largely in excess of the number born in the corresponding months of 1897, and also of the mean of the corresponding months, excepting August, of the ten years 1888–97. We noted that the birth-rate took a similar course during the year in the North-Western Provinces, Bengal and Madras : the first months of the year showing a low, and the last months a high, birth-rate as compared with the rates for the corresponding months of the previous year. The provinces mentioned resembled each other in one particular : all suffered over a greater or less extent of their areas from scarcity or famine in 1896–97. It is reasonable to attribute in all of them like results to the operation of like causes. This has been done by the Sanitary Commissioners, who account for the low birth-rate in the first half of the year under review chiefly to the influence on fecundity of the hard times under which a large proportion of the people had to live until the return of prosperity in the autumn of 1897. Contrary to what was observed in the vital statistics of the neighbouring Presidency of Madras, the birth-rate recorded in urban circles in Bombay falls far below the birth-rate in rural areas. For the Presidency the recorded urban birth-rate is 24·05, and the rural rate 31·91. In Madras, the ratio of births *per mille* of population in town circles was 33·0 and in rural circles only 26·9, according to Statement No. 1, Appendix D, of the Sanitary Report for that Presidency. We have thus in the one Presidency, towns recording a comparatively high birth-rate, and rural areas an abnormally low one ; and in the other Presidency the towns recording a low birth-rate and rural circles a comparatively high one. It is more probable that these contrary results are due to defective registration of vital statistics than to difference of social or other conditions prevailing in the towns and villages of the two contiguous provinces. In Bombay, 11 of the 56 towns in the Presidency return birth-rates of less than 20 *per mille* of their populations. In some of the rural areas also, the birth-rates recorded would seem to indicate neglect of registration. This is, as heretofore, especially the case in rural circles in the Sind collectorates : the rural part of the Hyderabad collectorate records the incredible birth-rate of 15·47, whilst the urban birth-rate in the same collectorate is 39·62. The abnormally low birth-rate recorded in several of the towns of the Presidency during the year is attributed to the decrease of their population owing to the exodus caused by plague. Bombay and Poona are examples. The former records a birth-rate of 13·08 and the latter of only 10·83. In Bombay city, however, defective registration of births contributes, it is pretty certain, to the abnormal lowness of the birth-rate.

4. The *death-rate* of the year under review declined from a ratio per thousand of population of 39·84 to 29·16. To the return of more prosperous times the decrease was, no doubt, mainly due. There was a decrease under the head of fever alone of no fewer than 150,081 deaths. Cholera and small-pox were also in comparative abeyance. The only disease which by its increase tended to raise the death-rate of the year was plague : the deaths from this cause, which numbered 46,944 in the previous year, rose to 86,191. Under the heading "other causes" the deaths recorded show a remarkable increase. The Sanitary Commissioner thinks this may have been due to better diagnosis of the diseases causing death ; but coinciding as the increase does with increase of plague mortality, it seems probable that cases of fever which in ordinary years, when plague is absent, would be recorded under their proper heading, were transferred to the head of "other causes." Colonel King gives grounds for believing that such transfers were made in Madras, and under similar conditions they may have taken place also in the Bombay Presidency : in both cases deaths reported as due to fever, which is a prominent symptom of plague, being likely to give rise to troublesome inquiries, the reporting agents found it convenient to report fever cases under the head of "other diseases." At any rate, the return given in paragraph 96 of the Report seems to support such an explanation of the sudden increase of the number of deaths recorded under the head of "other causes." From 97,104 in 1895 the deaths under this heading have increased to 100,112 in the following year, and thereafter in the two plague years of 1897 and 1898 to 143,503 in the former of these two years and to 176,335 in the latter. No doubt there may be some gradual improvement in the differentiation of the causes of death, but progress in this direction can hardly be so rapid as the sudden growth of the numbers recorded under the heading "other diseases" would indicate. A high birth-rate is usually held to accompany a high death-rate. This may hold good in countries in which health conditions are fairly constant from year to year ; but in a country like India, the incidence of famine or pestilence, or both together, may completely upset deductions regarding the death-rate founded merely on a knowledge

of the birth-rate. An examination of the statement on page 17 is interesting from this point of view. Taking the town at the top of the list of death-rates, Belgaum records a death-rate of 106·76 for the year under review. The same town is near the bottom of the column of birth-rates, with a record of a ratio of only 13·05 births *per mille* of population. Hubli, with a death-rate of 69·09, has a birth-rate of 18·72; and the town of Bombay, with a death-rate of 64·03, records a birth-rate of 13·08. Many similar examples might be quoted. Faulty registration is generally called in to account for the startling contrasts which are detected between the vital statistics recorded for different places or different years; but as the Secretary to the Government says in his review of the Report:—"The times have of late been so out of joint" that comparisons with previous years, or between different places, are of little value. The truth of this is very clearly established by a reference to the table given in paragraph 47. Here we find, for example, urban Belgaum recording a death-rate of 39·42 in 1897, and a death rate of 87·60 in the year following. Conversely, urban Poona records a death-rate of 85·89 in 1897, and one of 25·66 in 1898.

5. *Chief Diseases.*—The deaths from *cholera* were fewer than in any year since 1890. Of the total 4,368 deaths from this cause, no fewer than 4,054 occurred in the Dharwar collectorate alone. During the previous year cholera caused 57,100 deaths, the highest number recorded in any one year since 1879; the two consecutive years 1897 and 1898 thus show, respectively, abnormally high and abnormally low cholera death-rates.

6. *Small-pox* appears to be held well in check by the efficiency with which vaccination is carried out in this Presidency. Only 1,834 small-pox deaths were recorded in the entire Presidency, or equal to a ratio of 0·1 per thousand of population. During the previous year of famine the death-rate did not exceed 0·2 *per mille* of population; whilst the rate for the decennium was only 0·21. The Sanitary Commissioner is justified in claiming that "these figures may be considered very satisfactory, and testify to the exceedingly good vaccination work which now for some years has been done in the Presidency." It would be a pity, after the efficiency of the Vaccination Department has thus been proved by the approximately complete fulfilment of the purpose for which it exists, if circumstances should compel the Government to weaken its strength by the temporary withdrawal for other duties of some of its most important members. "Vaccination has suffered both in quantity and quality owing to the absence of inspection and supervision by the Deputy Sanitary Commissioners, who are the mainstay of the Department, and without whom efficiency cannot be maintained." An examination of the returns shows that there has been a serious falling-off in the number of successful vaccine operations during the past two years. In 1895–96 the successful primary vaccinations numbered 683,044. They showed only a nominal decrease in the following year; but in 1897–98 they went down to 626,170, and now, in the year under review, to 579,144. Accompanying this decrease in the number of successful primary operations, there has been a decrease in the percentage of successful cases from 93·23 in 1896–97 to 92·84 in the year under review, although it should be acknowledged that the latter percentage is an improvement on the figures for 1897–98. The decrease in number of operations is not confined to primary vaccination; revaccinations fell from 78,156 in 1895–96 to 51,154 in the year under review. The causes which led to this serious decrease in the amount of vaccination work arose from circumstances beyond the control of the Department. "Work in all the districts was effected by the absence of Deputy Sanitary Commissioners and by their posts not being filled up by full-time officers. In some districts inspectors and vaccinators have been absent on plague duty." The decrease extends to all the districts except the Presidency circle, but is most marked in the Southern District, "where a low birth-rate for the last two years and a severe plague epidemic during the present year greatly interfere with work, which was also affected by the absence of some inspectors and vaccinators on plague duty." Animal lymph is used to a considerable extent in this Presidency, but most of the operations still continue to be performed with human lymph. The proportion in which these two kinds of lymph were used in the Central Registration district is shown in the table in paragraph 5 of the Vaccination Report. There were 129,759 operations performed with human and 30,450 with animal lymph.

7. The number of deaths recorded as due to *fever* include also the deaths from *plague*. The combined total from both diseases was 302,515 a number less by 150,081 than the previous year's total, and less than the decennial mean of 384,710. Excluding the 86,191 deaths from plague, the fever deaths number only 216,324, the lowest number referred to this cause for many years. In other words the year was a healthy one. Not only did the return of prosperity enable the people to regain and maintain their health, but the pressure of hard times during the previous year had doubtless caused the disappearance of many of the weakly, who might otherwise have struggled on to die in the year under report and swelled its death roll. The fever deaths recorded in 1897 numbered, including plague deaths, 452,596 against 302,515 in the year under review. There was also a striking decrease in the mortality from *dysentery* and *diarrhœa*, due chiefly, there can be no doubt, to the causes which brought about the decrease of fever mortality. The death-rate fell from 4·57 in the previous year to 3·02.

8. An examination of the death returns shows that *plague*, notwithstanding all the efforts to circumscribe its area, had effected an entrance into each of the collectorates of the Presidency, excepting two of the Sind Registration Circle. Yet, in only three of the collectorates was the mortality serious. The greatest number of plague deaths, 27,764, occurred in Dharwar; in two only of the other collectorates did the deaths number ten thousand. So far, the increase in plague mortality has been rapid. From 2,086 deaths in 1896 the number rose to 46,914 in the following year, and now to 86,191 in the year under review. The amount of work which fell to the share of the Port Health Officer of Bombay was enormous. No fewer than 71,498 vessels of all sorts, with 1,207,571 crew and passengers, were examined during the year. The total number of plague cases detected during 1898 was 118. Among other difficulties Major Crimmin had to contend against in carrying out his work, was the objection raised by the natives to their temperature being taken by placing a clinical thermometer in their mouths. "Every possible precaution had been taken to

remove sanitary or sentimental objections. The thermometers were washed in carbolic acid lotion and afterwards in a stream of water from a tap. Each caste had its own set of thermometers, and temperatures were taken by one of their own caste people; but the system had to be abandoned owing to caste prejudices."

9. The Sanitary Board puts the position very clearly as regards the progress of *sanitary works*. "Owing to the expenditure incurred by municipalities in connection with the plague, and to their reduced incomes from the restriction of trade due to the plague, almost every municipality has shelved the consideration of all important sanitary works." The report of the Board is brief and very much to the purpose. No circumlocution is used in bringing to notice municipal shortcomings, but unless the Board is intrusted with executive as well as consultative powers, its criticisms and recommendations will continue to have, as heretofore, little immediate result.

10. *Summary.*—The year in its main meteorological features was somewhat like its predecessor. The rainfall was up to the average and fairly well distributed. Prices of food grains were greatly lower than in the previous year. This fall in the prices of food grains was followed by a marked improvement in the public health. The prevalence of plague alone kept the year from being one of the healthiest on record. The death-rate fell from 39·84 in the previous year to 29·16. The birth-rate, being much influenced by antecedent conditions, was abnormally low during the first half of the year; during the last five months, on the other hand, in response to the return of better times towards the end of the preceding year, and in the earlier months of 1898, the birth-rate shows a very decided increase over the rate for the corresponding months of the previous year. The record of births followed the same course in the other provinces simultaneously affected by famine. The disturbing influence of famines and destructive epidemics on the relation which the birth-rate of a country ordinarily bears to its death-rate is well exemplified in the statistics of the Bombay Presidency during the year under report. Cholera, small-pox, and fevers were all of them less fatal than usual. There were only 4,368 deaths credited to cholera during the year. The small-pox deaths numbered 1,834, giving a death-rate of 0·1. The protective influence of vaccination, efficiently carried out, is well exemplified by the record of small-pox mortality for many years past in the Bombay Presidency. Unfortunately, stress of work in connection with plague prevalence and prevention necessitated the withdrawal from their proper duties of Deputy Sanitary Commissioners and other officials of the Vaccination Department, with only the result that was to be anticipated. There has been a serious decrease in the amount of vaccination work during the year. Both human and calf lymph continue to be used in the Bombay Presidency, the former still in by far the greater proportion. Fever deaths in the return include also those from plague. Of these latter there were 86,191 spread over every Registration District. The only two collectorates in the entire Presidency which have returned no deaths from plague are in Sind. The expenditure incurred owing to the prevalence or apprehension of plague has brought the finances of municipal bodies to a low ebb. The prosecution of important sanitary works will have to await the return of more prosperous times.

29th May, 1900.

No. 12.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1898.

The year under report was exceptionally healthy, contrasting strongly with its predecessor, which, with the single exception of the famine year of 1878, showed the highest death-rate on record. The acute distress from which the people had suffered until towards the end of 1897 was followed by a season of prosperity and rapid restoration of the public health. To this restoration the fall in price of food, the absence of epidemics, and favourable climatic conditions mainly contributed. The table on page 9 of the Report shows *jowari*, the staple food-grain of the people, to have fallen to less than half the price which ruled in the previous famine year. The year was colder and the rainfall less than in 1897. No doubt also the privations and hard times which preceded the year under review had weeded out from the population many of the diseased and the feeble, leaving the survivors with a higher average expectation of life.

2. The *birth-rate* being influenced largely by antecedent conditions was, in accordance with what might have been anticipated, a low one. From 39·7 *per mille* of population in the unhealthy year 1897 it fell to 31·3, the lowest recorded since 1873, or since the registration of vital statistics can safely be trusted. Unfortunately, although a return is given showing the death-rates for each month of the year, there is no corresponding return of the birth-rates; but if the birth-rate in Berar followed the same course as it followed in other provinces afflicted by famine in the preceding year, it would be found that, whilst the first six or seven months of 1898 recorded rates below those recorded during the corresponding months of 1897, the last five or six months recorded, on the contrary, higher rates than did the last five or six months of 1897. The lower birth-rates of the first half of the year would be influenced by the conditions of distress which prevailed in the previous year until the gathering in of the abundant autumn crops brought back better times; the increased birth-rates of the last months of 1898 would correspond with the cessation of distress and return of prosperity after the autumn-crops of 1897 had been reaped. But without the actual monthly birth returns, the course which the birth-rate followed during the year can only be inferred from the course which it is known to have followed in other provinces under more or less similar conditions.

3. The *death-rate* was the lowest recorded for any of the last 17 years. During the years prior to 1880, the Sanitary Commissioner thinks vital statistics were too imperfectly recorded to admit of their being used for comparison with those of later years. The mortality from all the principal diseases, excepting small-pox, shows a very marked decrease in the year under review as compared with the mortality of 1897. In the case of small-pox the death-rate was the same in both years. The Sanitary Commissioner thinks that the improvement of the public health in Berar consequent on the disappearance of famine and the return of prosperity was not the sole cause of the striking reduction in the mortality of the year. "Probably the starving immigrants who flocked to Berar without let or hindrance to partake of its hospitality contributed a large number of deaths in 1897, which served to raise the death-rate of that year; that their departure after the distress ceased served to lower the death-rate in 1898." In this way conditions not inherent in a tract of country, but introduced from outside, might produce an increase or decrease in its birth and death rates which, without explanation, might lead to the formation of erroneous conclusions regarding the health of its population. An example of such extraneous influence on the vital statistics of a district was given in the Sanitary Commissioner's report for the previous year. In that report he states that the explanation of the high death-rate in Amraoti was to be found in the situation of that district with regard to the neighbouring Central Provinces. From the latter the starving poor flooded the Amraoti district, seeking for work and food. Numbers of them died from the effects of chronic starvation, from which they suffered before reaching Berar, with the result of unduly raising the death-rate. The contrast between the health of the year under report and its predecessor is well shown in the infantile mortality recorded for each of the two years. In 1897, of children under one year of age there died 378·4 of every 1,000 of that age living; in the year under report the number was 181·8, or less than half.

4. Registration of vital statistics in the Province of Berar continues to receive much attention. Every available check, the Sanitary Commissioner states, is employed to improve registration. In the Resident's review of the Sanitary Report it is pointed out that the number of registers tested by civil surgeons during the year is far less than it ought to have been. The returns show that only 42 registers were tested by these officers in the entire Province. If the supervision of vaccination is one of the duties of the civil surgeons in Berar, as it is in other provinces, these officers, when visiting the villages in their districts for the purpose of inspecting the work of the vaccinators, must have many opportunities of testing at the same time the accuracy of the registration of births and deaths in those villages. As showing the opposite results attained by the systems of registration in force in different provinces, we read that in Berar "registers in villages are much more correctly kept than in municipal towns." In the Presidency of Madras, on the contrary, the registration of vital statistics in towns is far more complete than in rural areas. Needless to say that in India, the vastly greater proportion of the population being rural, it is more important to secure approximately accurate registration in rural areas than in towns. In Berar the total rural population numbers, according to last census, close on two and a half millions, whilst the urban population numbers only 356,000.

5. *History of Chief Diseases.*—From *cholera* there was not a single death recorded. During neither of the previous three years did the number of deaths from this disease fall below 10,000. The Sanitary Commissioner puts the question:—"Can this year's immunity be attributed to a reduced maximum and minimum temperature, a reduced humidity and rainfall, as compared with the previous year? These were the features of the year somewhat similar to those of 1873, as compared with 1872." Like the year under review, 1873 did not record a single case of cholera. The speculations of the Sanitary Commissioner are disposed of by the Resident in his review of the report as follows:—"The absence of importation of the disease, and the consequent freedom from contamination of the drinking water, are sufficient to account for the freedom of Berar from cholera in 1898."

6. From *small-pox*, 592 deaths, equal to a ratio of ·2 *per mille* of population, were recorded. In the previous year the number of deaths was somewhat higher. A single district, that of Buldana, contributed by far the greater number of the deaths, returning a death-rate of ·9 as compared with ·2 for the Province. Vaccination made satisfactory progress. The number of primary vaccine operations shows a decrease of 1,016 as compared with the number for the previous year, due, the Sanitary Commissioner is of opinion, to the decrease in the number of births during 1898; but there was an increase of 8,630 cases of revaccination over the number recorded in 1897–98. The proportion which the number of re-vaccinations bears to primary vaccinations is very high, 38,871 of the former to 94,032 of the latter. Unless vaccinators are well trained, and understand how to keep up the quality of their vaccine lymph, there is no little risk of the lymph degenerating when a high proportion of re-vaccination is performed. An experienced vaccinator would not use lymph taken from re-vaccinated subjects for the purpose of carrying on his operations, knowing that such lymph could rarely be trusted to reproduce the genuine vaccine vesicle; but new and ignorant vaccinators, and there are usually not a few of them in most provinces, may fail to distinguish between a typical and a modified vesicle, and by using lymph from the latter may lead to the deterioration of his work, and incomplete protection against small-pox. Of course, where, as in Madras, only calf lymph is used in all cases of vaccination and re-vaccination, there will be no risk such as that alluded to. The Sanitary Commissioner says:—"The vaccinators were also urged from time to time to increase re-vaccination." This may safely be done if only lymph from the calf is used by the vaccinators, but in Berar calf lymph, as we read paragraph 3 of the report, was used only so far as to start off the season's work. It must not, however, be overlooked that very great care is taken in this Province to see that re-vaccinations are not returned as "successful" unless they fulfil all the conditions needful to entitle them to be considered so. The Sanitary Commissioner personally inspected 234 cases of re-vaccination, and found of this number that "14 only were perfectly successful." Under the scrutiny to which re-vaccination is subjected in Berar, the percentage of successful cases is as low as 23·1; in the neighbouring Central Provinces the recorded percentage is 87·87. Next to the reduction of the mortality from small-pox in Berar to a lower ratio

than that reached in any other province of India, except Bengal, the best proof of the efficiency of the Department is the high percentage of children under one year of age who are annually protected. During the year under report 69,877 infants under one year of age were successfully vaccinated, against 89,414 births registered. But as 16,621 deaths of children under one year were recorded in the calendar year 1898 only 72,793 children would remain available for vaccination. Of this latter number, therefore, all except 2,906 were protected against small-pox by successful vaccination. The 2,906 would probably consist mostly of infants not in a fit state to undergo vaccination. Seeing that the 12 months of the calendar year do not all of them coincide with the 12 months of the vaccination season, the figures given are only an approximation, but probably a pretty close one, to the actual figures.

7. The decrease in mortality from *fever* and *bowel complaints* was very marked. The ratio of deaths from the former fell from 23·0 in the previous year to 11·5 in the year under report, whilst the ratio of deaths from dysentery and diarrhœa fell from 10·3 to 3·5. As regards fever, the Sanitary Commissioner writes :—"A reduced temperature, humidity, and rainfall as compared with the previous year appear to have lessened the deaths from this cause considerably"; whilst he thinks the same cause or causes that freed the Province from cholera and reduced the death-rate from fevers appear to have operated to reduce the mortality from dysentery and diarrhœa. But probably the cause which of all others did most to reduce the death-rate from bowel complaints was the cessation of the famine conditions of the previous year, and the return of more prosperous times with a more abundant and wholesome dietary.

8. Although plague approached the borders of Berar from both the Bombay and Central Provinces sides it did not succeed in obtaining an entrance. As the Commissioner writes :—"Considering how near plague approached Berar from both Khandeish and Wardha, I think that its check on our very borders may be fairly attributed to the efforts of our villagers themselves, strengthened by the assistance and guidance of the district authorities.

9. *Sanitary Works.*—During the past year there has been some decrease in the expenditure on sanitary works, chiefly under the heads of drainage and water-supply. It must tend to discourage municipalities in the prosecution of sanitary improvements in their towns to find that some of the schemes on which they have expended their resources have ended in partial failure. "More than one municipality," writes the Commissioner, "has reason to be grieviously disappointed with the results of a costly scheme of water-supply."

10. *Summary.*—The year was exceptionally healthy. The distress and privations of the previous famine year had given place to better times, under the influence of which the public health was rapidly restored. The birth-rate, owing doubtless to antecedent conditions unfavourable to health and fecundity, decreased from a ratio of 39·7 per thousand of population in the previous year to 31·3. The death-rate was the lowest recorded for 17 years, falling from 52·6 in 1897 to 23·4, or to less than half. Of cholera there was an entire absence, whilst small-pox was credited with the same death-rate of ·2 *per mille* of population as in the previous year. Vaccination made satisfactory progress. Although the number of primary operations was somewhat below the number recorded in the previous year, there was a large increase in the number of re-vaccinations. Under the rigorous scrutiny to which re-vaccination cases are subjected in Berar, the percentage of successful cases recorded was only 23·1; in the neighbouring Central Provinces the percentage was 87·87. The high percentage of children under one year of age successfully vaccinated continues to be a satisfactory feature of each season's work. Fevers and bowel complaints were much less fatal than in the previous year, the ratio of deaths ascribed to the former falling to less than half, and the ratio ascribed to the latter to about one-third. Although approaching close to the borders of Berar, plague did not obtain an entrance into the Province. There has been some decrease in the amount expended on sanitary works, chiefly under the heads of drainage and water-supply. Unfortunately, certain of the water-supply schemes carried out at much cost by municipalities have not proved so successful as had been anticipated.

25th May, 1900.

No. 13.

Memorandum by the Army Sanitary Commission on the Administration Report of the Town of Calcutta for 1898–99.

The Health Officer's Report covers only 34 pages, and of these nearly a third are devoted to an elaborate account of the 142 cases of small-pox which were brought to notice during the year. On the other hand, no history of plague, or of the measures adopted with the object of preventing its entrance into the town, or of stamping it out after it had obtained an entrance, is given. It appears that, by order of the Lieutenant-Governor, the Health Officer was relieved of the supervision of the plague operations in order that he might thus be enabled to devote his entire attention to the conservancy of the town. A somewhat similar arrangement, it may be remembered, was considered to be expedient in Bombay; but in the case of the latter city the Health Officer devoted a large portion of his annual report to a history of the plague, and of the operations carried on with a view to its arrest. A Health Officer's report can hardly be considered to be complete which makes only casual mention of the disease which, more than any other, influenced the sanitary measures of the year. "It would be out of place on the present occasion," writes the Lieutenant-Governor, "to discuss the policy which has actuated the Government in dealing with the plague in Calcutta, the measures which were from time to time adopted, or the success or failure which attended them.

This will be done when the history of plague in Bengal comes under review." The attempt to separate a particular disease from all the others and to deal with its causes, prevention, and eradication as matters apart from the general conditions affecting the public health, could scarcely be expected to commend itself to a Health Officer. To begin with, the differentiation of plague, even by experts, from other diseases is not infrequently found to be a matter of great difficulty. It is only necessary to mention the close resemblance of fevers, and especially of relapsing fever, to plague. In the case of the latter disease even a bacteriological examination may be necessary before it can be distinguished from plague. As to preventive plague measures, experience appears to show that the most reliable of them are those which apply to the prevention of diseases in general, and that it is safer on the whole to trust to these than to measures which, in a country like India, can be evaded in spite of the utmost practicable vigilance.

2. The year was cooler than the average, and its rainfall, which amounted to 69·88 inches, was above the average of 66·39 inches. The bulk of the rainfall took place between the last week of June and the third week in July. The price of rice and *dhal* was below the average of the preceding five years. Common rice, the staple food of the poor, sold at Rs. 4. 6 per maund against Rs. 5. 2. 3 in 1897–98. Notwithstanding that plague made its appearance and accounted for 192 deaths, the year was an exceptionally healthy one. The death-rate was below the average, partly owing to lessened mortality from cholera and small-pox, and also, but to an uncertain extent, to the exodus of a considerable portion of the population in consequence of the plague scare.

3. The total number of *births* registered fell from 12,584 in the previous year to 9,530 in the year under report, or from a ratio per thousand of population of 18·4 to 13·9. The birth-rate of Calcutta, always low, owing chiefly to the small proportion of females, there being only 100 females to every 174 Hindu and 197 Mussalman males, was exceptionally low in 1898, owing to the exodus following the plague scare. An additional cause of the decrease in the number of births is the custom among women of leaving the town and proceeding to their houses in the country to give birth to their children, a custom which, as stated in the Government review of the report, was of course greatly strengthened by fear of plague. The number of still-births recorded was 720, or 7·5 to every 100 live births, and not to every 1,000 as stated, probably from oversight, in the report. This proportion is more than three times that recorded in Madras, but only half the proportion in Bombay. In the former, it is said that a considerable number of still-births remain unrecorded, and in the latter, it is believed that if all the live births were recorded, the ratio of still to live births would sensibly diminish.

4. The *death-rate* decreased from an average of 34·80 for the previous five years to 29·8 in the year under review, and was the lowest since 1893. The year was a healthy one, the price of food was below the average, and there was less mortality from cholera, small-pox, and fever; whilst the temporary diminution of the population consequent on the exodus due to the plague panic, or to the measures considered necessary for combating plague, combined with the other causes to reduce the death-rate of the year below the average of the previous five-year period. The infantile death-rate, always an unfavourable feature of the vital statistics of Calcutta, was below the average, owing partly, no doubt, to the exodus already mentioned, but was still very high. Amongst Mohamadans it reached the enormous ratio of 634·5 to every 1,000 births. For urban and suburban Calcutta combined, it was 368·5 of children under one year of age, as compared with 437·5, the mean of the previous five years.

5. *Chief Diseases.*—The recorded mortality from fever was less than it has been since 1889. This decrease the Health Officer considers to be satisfactory, and were it an actual instead of only an apparent decrease there would, no doubt, be ground for such satisfaction. But it is evident that the same influence was at work in Calcutta which in Madras and Bombay caused the decrease of the number of deaths recorded under the head of "fever" by their transfer to the head of other causes." In the words of the Health Officer:—"The returns of deaths from fevers in 1898 were lower than they should have been, as after the appearance of plague many people registered deaths under 'other causes' which would in other years have been registered under fevers." A reference to the statement on page 34 of the report seems to lend support to this conclusion. In 1898 the number of deaths therein attributed to fever fell from a mean of 8,426 to 6,060; at the same time the number of deaths recorded under the head of "other causes" rose from a mean of 8,312 to 10,267. The reduction in the number of fever deaths was thus to a large extent balanced by a corresponding increase in the number of deaths ascribed to "other causes." Believing that there is now sufficient ground for basing practical measures on the discoveries of Dr. Ross in connection with the part which that officer ascribes to the mosquito in the causation of malarial fever, the Health Officer hopes shortly to submit proposals for the employment of a few men in the extermination of mosquitoes in their breeding grounds. The proposed experiment will be watched with much interest.

6. *Cholera* was less fatal than in any year since 1889, the year in which the town and suburbs of Calcutta were amalgamated. The total number of deaths credited to this disease was only 605, against an average of 2,181 for the period 1889–97. And even from this number should be deducted 101 cases imported from beyond the limits of Calcutta, leaving 504 fatal indigenous cases. The causes of the attacks do not appear to have been determined with more precision than usual. For example, in describing the particulars of a local outbreak in the Sabjibagan busti, limited to four attacks, the Health Officers writes:—"The first was a girl of 12 years of the Bagdi caste, who was attacked on the 4th and died on the 6th February. No special cause was traced in her case. She contaminated a tank in the busti, and three other cases followed." One would like to know some particulars regarding the mode of contamination of the tank by the girl, and of how this contamination led to three, and only to three, attacks in what was doubtless, being a busti, a crowded neighbourhood. From what follows, it would appear that water is not regarded as the only medium by means of which the disease infection may be introduced into the human body. Describing the case of a coolie who was attacked on the 14th April and died the same day, the Health Officer says:—"The

attack was associated with the consumption of rotten sweetmeats obtained by begging from shopkeepers on the Bengali New Year's Day." Again, in another case :—"The cause of attack would seem to have been polluted drinking water supplied by a Bhisti in his skin bag in which he had been carrying tank water for watering roads. This patient contaminated a foul tank which directly communicated with another, and thus two more cases took place close to those tanks." Statements of the nature of those quoted are too inexact, it is feared, materially to advance our knowledge of the causation of cholera.

7. *Small-pox* was present in Calcutta during all the months of the year except October, but the total number of deaths attributed to the disease was only 85. Of the 142 attacks 59·4 per cent. proved fatal. Of the 142 cases, 33, or 26·7 per cent., had been vaccinated, and the mortality amongst the latter is stated to have been 44·9 per cent. Possibly the explanation of this enormous proportion of deaths to attacks may be that only a portion of the total number of the vaccinated who were attacked by small-pox came to notice, and that these were mostly confined to the gravest cases. The same explanation might, perhaps, apply to the record of 63·6 per cent. of deaths to attacks amongst the unvaccinated. Some support would seem to be given to such a hypothesis by a remark made to the effect that, in one quarter of the town at least, the search for persons suffering from small-pox "met with much resistance from the residents." The concealment of the slighter cases would, perhaps, be more successful than that of serious or moribund cases. The difficulty of stamping out the disease was increased during the year under report by the plague scare. The people, suspecting the vaccinators to be somehow connected with plague inoculation, assumed a hostile attitude to, and even assaulted, some of them, with the result that all vaccination work was stopped, by order, for three months. Chiefly as a consequence of the plague scare which led to this temporary suspension of vaccination, and to the exodus of a large proportion of the residents from the town, there was a decrease in the number of primary vaccinations in the year under review as compared with the number in the previous year. Primary vaccinations fell from 13,297 to 11,569, and revaccinations from 8,323 to 1,686, thus showing a decrease of 1,728 of the former and 6,637 of the latter. The large decrease in revaccinations is ascribed to the absence of the stimulus which a small-pox epidemic gives to revaccination. As already stated, small-pox caused only 85 deaths during the year. The percentage of success in primary vaccination, excluding unknown cases, was 99·07, as compared with 97·59 in the previous year. Of the 1,686 revaccinations, excluding unknown cases, 23·68 per cent. were successful, against 16·51 in the previous year. The contrast between the percentage of success in revaccination recorded in Calcutta, 23·68, and that recorded in Madras, 83·18, is very remarkable. In addition to the 13,255 primary operations and revaccinations combined, there were 158 of the former and 2,190 of the latter performed by Government officers of the Animal Vaccination Department, Calcutta, in private European houses and in public institutions, not included in the returns of the Vaccination Department of the Corporation. It seems a pity that all of the vaccine operations performed in Calcutta could not be included in the same return. Of infants under one year of age, only 3,198 were vaccinated; but those vaccinated between the ages of one and six years numbered 8,025. Although the Compulsory Vaccination Act is in force in Calcutta, it does not compel the people to have their children vaccinated before they have completed one year of age. The consequence of this rule is seen in the small-pox mortality returns for the year. Of 85 deaths recorded, 13 were those of children under one year of age. The state of vaccination in Calcutta is, in the opinion of the Health Officer, "very bad"; and he has submitted a scheme for the reorganisation of the Department. One of the chief features of this scheme is the appointment of a more highly trained and better paid class of vaccinators. "Our vaccinators," writes the Health Officer, "receive the pay of coolies, and are not proper persons to decide whether children are in a fit state for vaccination, and the other responsible duties of their office." The scheme has received sanction since the close of the year. Summonses were issued under the Vaccination Act in 408 cases, but only 48 cases had ultimately to be heard in court, with the result that in 44 cases the offenders were fined, and in two warned and discharged, while two cases were pending at the end of the year.

8. *Sanitary Works.*—The apprehension and presence of plague have given an impetus to sanitary improvement. One of the chief defects in Calcutta is the site-crowding, which from year to year was pressed on the notice of the municipality by the former Health Officer, Dr Simpson. The present Health Officer, dealing with the question, writes :—"Anyone experienced in sanitary matters can see that nothing approaching an average standard of sanitation can be attained without to a considerable extent demolishing and reconstructing the town." Timely interposition on the part of the authorities might have prevented much of this site-crowding, and so have saved a vast expenditure of money which will be required to remedy it. The filling up and improvement of tanks continues to be carried on from year to year. The Health Officer in describing the state of the cow byres says they are badly constructed, ill-drained, and over-crowded. "The results of analysis show that most of the milk sold in Calcutta is adulterated with water to the extent of from 10 to 75 per cent." Thirty per cent. may be taken as a fair average of added water. Facts of this nature may help to throw light on the causes of the enormously high infantile death-rate annually recorded in Calcutta. Of the cow-keeper who habitually adulterates the milk he sells, the Health Officer writes :—"It would be interesting to know how many infant lives this simple-minded felon accounts for on the average in a year. Fortunately for the infants the native mother has generally a proper sense of the duties of maternity and nurses her child."

9. *Summary.*—Notwithstanding plague, which accounted for 192 deaths, the year was exceptionally healthy. The price of food was below the average. There was no destructive epidemic. Cholera was less fatal than in any year since 1889, and small-pox had attributed to it only 85 deaths. The mortality credited to fever was less than the average for the previous five-year period; but there are grounds for believing that this decrease is largely counterbalanced by an increase in the number of deaths recorded under the head of "other causes." The plague panic led to the registration of many deaths as due to "other causes" which were in reality due to fever. Vaccination work suffered much from a suspicion which got abroad amongst the people that it was somehow connected with plague

inoculation. As a consequence of the spread of this suspicion, people not only refused to have their children vaccinated but in some instances assaulted the vaccinators. For nearly three months during which this hostile attitude of the inhabitants towards vaccination continued, vaccine operations were stopped by order of the Chairman of the Corporation. There was a decrease in the number of primary vaccine operations, but the percentage of successful cases rose from 97·59 to 99·07. Of revaccination there was a large decrease, due, the Health Officer thinks, in main part to the absence of the stimulus which small-pox in severe epidemic form gives to vaccination. A scheme has been proposed by the Health Officer for the reorganisation of the Vaccination Department. One of the most important features of this scheme is a proposal to improve the training and increase the pay of the vaccinators. Sanitation in Calcutta has naturally received an impetus from apprehensions and presence of plague. The site-crowding, which has been permitted to grow up and become a notorious feature of the town, is one of the chief sanitary evils which have to be grappled with : the application of an effectual remedy will be a big and costly undertaking.

29th May, 1900.

No. 14.

Memorandum by the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1898–99.

According to the table on page 41 of the report, the rainfall recorded for the calendar year 1898 was 68·14 inches. It was below the average in January and from March until July, and above the average in the other months. The excess for the whole year was 19·12 inches. The fall between the 15th of October and the end of the year was 43 inches as compared with 9½ in the previous year, and with an average of 26 inches. The temperature was below the average in January, March, September, and October, normal in November, and above the average during the other months. The prices of the staple food grains, second quality rice and *ragi* ruled much above normal for the whole year, with a slight tendency to fall in December. But even during the latter month a rupee, which ordinarily would buy 12·1 seers of rice, or 24·8 of *ragi*, bought only 10·3 of the former and 16·4 of the latter. Thus, 1897, with a greatly lower rainfall between the middle of October and the close of the year, together with cheaper food, recorded 2,616 more births than deaths, whilst 1898 with a vastly greater rainfall during its last two-and-a-half months, and with higher prices of food, recorded 1,592 more deaths than births. Without claiming that the difference in the vital statistics of the two years is exactly reflected in the difference of their food prices and climatic conditions, there can be little question that the former were largely influenced, as they usually are, by the latter.

2 An examination of the statement of *births* at page 30 of the report shows that the ratios were, excepting in June, lower during the first seven months of the year under report than in the corresponding months of 1897 ; and that, on the other hand, the ratios for each of the last five months were so much higher in 1898 than in the previous year as to make good the deficiency in the preceding months, the total ratio of 41·3 coming out the same for both years. We have noticed that almost the same course was followed by the birth-rates of the two years in the provinces subjected to famine or abnormally high prices in 1896–97. It has to be noted, however, that whilst elsewhere there was generally a fall in the prices of food following the cessation of famine conditions and the return of prosperity, in Madras city food prices were higher in 1898 than in 1897. The total number of children born alive during the year under report was 18,694, or only eight fewer than in 1897. There were two still-births to every 100 children born alive. This is somewhat less than the proportion recorded in 1897, which was regarded by the President as unquestionably too low for a city like Madras. In the present report it is said :—"No doubt there is still considerable concealment owing to popular prejudices, and dead children are easily got rid of in this country." The popularity of lying-in hospitals appears to be peculiar to Madras : nearly three thousand births took place in these institutions during the year, according to paragraph 170 of the report. In other Indian cities public lying-in hospitals, if they exist, are comparatively little resorted to.

3. There were 20,286 *deaths* recorded, against 16,086 in the previous year, giving a ratio per thousand of population of 44·8 as compared with 35·5 in 1897. The mortality according to sex would seem to indicate a preponderance of females in the population of Madras city. Of females, 10,333 died during the year under report as against 9,953 males, or in the proportion of 100 of the former to 93 of the latter. According to paragraph 168 of the report the population of Madras city is composed of the two sexes in almost equal numbers, females exceeding males by only 884 in a total of 452,518. The contrast between these numbers and the numbers for Bombay city are remarkable. In the latter, females instead of being in excess, as in Madras, are only in the proportion of 100 to 170 males. The increase of 4,200 in the number of deaths over the number in the previous year was due to greater mortality under the head of all the principal diseases, but chiefly under the heads of cholera, dysentery, measles, and "other diseases." Ordinarily, when there is a large divergence between the number of deaths recorded in any two years, fevers take their share in bringing this about. But in each of the years 1897 and 1898 the numbers of deaths attributed to fevers were practically the same—5,484 in the former and 5,489 in the latter.

4. *Chief Diseases.*—Not since 1891 has there been so fatal an epidemic of *cholera*. The disease prevailed in sporadic form during the last three months of 1897, and in January of the year under report caused 47 deaths. From this time onwards it decreased until only one death was recorded against it in June. In the following month, however, the disease suddenly assumed an epidemic

form, causing 94 deaths and reaching its climax with 311 deaths in August. During the remaining four months it again gradually subsided until, from causing 176 deaths in September, 19 deaths only were attributed to it in December. As in most other years, the months of greatest cholera prevalence in Madras were those of August, September, and October. In the case of two houses the President considers that the disease could be traced to the use of well water. "In both instances there were latrines within the drainage area of the well." Every division of the town suffered; but the incidence of the disease was most severe in the First Division, which includes some of the most insanitary centres. Colonel Weir has noticed that in Bombay children are less liable to cholera than adults: this also has been observed to be the case in Madras city. Endeavours to isolate those attacked by cholera were not apparently more successful in Madras than elsewhere. Experience seems to show that attempts at isolation do perhaps more harm than good, by causing the people to conceal cases of the disease. As notification of cholera cases led to disinfection of the houses in which these occurred, and as disinfection was disliked by the people, medical practitioners found that, in their own interests, notification was inexpedient. The consequence was that "the instances in which notification was given were but few."

5. The total number of deaths due to *small-pox* was 116, or two more than in the previous year. This gives a ratio of ·2 *per mille* of population as compared with ·6 for the Madras Presidency as a whole. The statements given in paragraph 175 deserve attention. Of the 116 persons who died of small-pox in Madras city during the year, 50 were unvaccinated, 40 said to have been vaccinated but had no marks, whilst 26 had been vaccinated. Of 23 deaths among the vaccinated, 14 are stated to have taken place amongst children under 10 years of age, and nine amongst persons beyond 10 years. So many as 14 deaths occurring amongst children within less than 10 years of the time of their having been vaccinated out of a total of 177 vaccinated persons attacked, suggests the need for inquiry as to the genuineness of the vaccine lymph used and the qualifications of the vaccinators employed in using it. Taking two as the minimum number of vaccine marks necessary to indicate a fair amount of security against small pox, the mortality per cent., according to Marson's tabulated results, amongst persons attacked by small-pox who can show two such marks, is 4·70 per cent. With four or more marks the mortality per cent. is only 0·55. During the year 1898–99 the total number of persons vaccinated was 28,186, showing a decrease of 4,896 compared with the number for 1897–98. The recorded percentage of successful cases, at the same time, fell from 96·76 to 95·79; but this decrease "was due to the low percentage of success obtained in revaccination." The ratio of successful cases in primary vaccination was practically the same in both years: in revaccination it decreased from 86·97 to 83·18. Regarding these latter figures the remark is made in the Government review of the report:—"The percentage of success in the case of revaccinations is, however, not above suspicion, seeing that a careful investigation of the matter made by the Sanitary Commissioner has shown that the normal rate of success in revaccination must be between 75 and 60 per cent." In the Government review it is estimated that, after deducting the number of children who died under one year of age from the total number of births registered, there remained available for vaccination 12,881. The number of children under one year of age who were successfully vaccinated was 13,381; so that it might at first sight be concluded that vaccination must be very complete, seeing that the number vaccinated is in excess of the number estimated to be available for vaccination. But it is pointed out by the Government that, of the 13,381 successfully vaccinated, only 9,500 appear to have been born in Madras; "and it is stated that the 3,044 births which occurred in the hospitals were not traced by the vaccination staff for want of sufficient information. It is thus evident that more than one-fourth of the children under one year available for vaccination and born in Madras remained unprotected. This is not satisfactory, and the Government trusts that adequate steps will be taken to improve matters." Calculated on the census figures, 62·2 *per mille* of the population were vaccinated in 1898–99, a ratio far above the birth ratio, which was only 41·3. Of the total number of 28,186 cases vaccinated during 1898–99, the various inspecting agencies verified 20,586. Calf lymph is used; and that the people may have no excuse for neglecting to avail themselves of vaccination, on certain days of the week, the "calf is sent round with the vaccinators to the crowded paracherries, fishermen huts of Cassimode and Tinnivelli Settlement huts, and the unprotected are vaccinated on the spot."

6. The deaths from *fever* were practically the same in number as in the previous year. It is noted that in October the numbers registered suddenly fell. This decrease was attributed, to some extent, to the fear the public had that troublesome investigations might follow the notification of fever cases during the time that apprehensions were entertained of a plague epidemic; fever cases being regarded with suspicion by the sanitary authorities so long as the diagnosis was incomplete and there seemed any risk of their being really cases of plague.

7. Fortunately, *plague*, although 15 cases were imported up to the 31st of March, 1899, did not secure a footing in the city of Madras. Additional hospitals and segregation camps were prepared and kept in readiness for immediate occupation by plague cases. An effort was made to subject all persons to surveillance arriving in Madras by train from infected localities. The President writes:—"The system worked fairly well, but of course a certain percentage of arrivals altogether escaped observation, and could not be traced either by the sanitary staff or the police. It is good luck alone that has saved the city from indigenous cases, which might very well have followed, if one of these persons who eluded the utmost vigilance manifested had developed plague and died unknown." Like all such measures devised with the object of protecting places in direct communication by land with infected localities against importation of disease, the measures adopted at Madras are admitted to have been an incomplete safeguard against plague. The President acknowledges that however carefully and zealously put into execution "loopholes of escape are found in every part of the system depended on." Amongst other precautionary measures adopted against plague, an attempt was made to destroy the rats and mice in the city. This failed. No impression appeared to be made on the total rat population, in spite of the rewards offered for their destruction. Inoculation with Haffkine's prophylactic was commenced, and altogether 5,853 persons were operated upon.

8. *Sanitary Works.*—It is stated in the Government review of the report that:—"No substantial advance was made during the year in the sanitary condition of the city, but several important steps were taken which may be expected to effect an improvement in future." The Mylapur drainage system was, however, opened, and is said to be, on the whole, a great success. Drainage of the other quarters of the city continues to be one of the chief sanitary requirements of Madras. The President calculates that, after the disposal of 4,200,000 gallons of sewage daily on the existing farms, or by discharge into the sea, there remain of the 8,210,000 gallons of pipe water daily used 4,010,000 gallons to be soaked into the soil or evaporated. And this is an under-estimate of the soakage, as no account is taken of the additional quantity raised from wells. The removal of only half the quantity of water introduced into Madras is thus arranged for, and the removal of the remaining half is perhaps the most important consideration in connection with the improvement of the health of the town. A satisfactory feature of the mode of disposal of a portion of the town sewage is its profitable utilisation on farms. A profit of Rs. 38,300 was realised from these farms during the year under report, as compared with Rs. 33,545 in the previous year, and with only Rs. 2,851 in 1896–97. A certain number of dirty and useless wells were closed during the year, but until the present intermittent water-supply is replaced by a continuous supply, the complete disuse of well water in Madras will not be practicable. Next to efficient drainage, this question of a sufficient and pure water supply is perhaps the most important. No satisfactory remedy seems yet to have been discovered for effectually dealing with the chronic difficulty experienced in obtaining a sufficient number of scavengers. When these go on strike, as they appear to do whenever it seems good to them, the inconvenience and even danger to the public health, consequent upon the non-removal or incomplete removal of night-soil and other refuse, cannot but be serious.

9. *Summary.*—The year was one of a rainfall much above the average, and also a year of higher prices of food. The rainfall during the last two and a half months of the year measured 43 inches, as compared with only 9½ in the corresponding months of the previous year. The birth-rate, 41·3 per thousand of population, was the same as that of 1897; but the death-rate rose from 35·5 in the previous year to 44·8. All of the chief diseases contributed to this increased mortality, but those which contributed most were cholera, dysentery, measles, and "other diseases." The number of fever deaths, contrary to what might have been anticipated in view of the unusually heavy rainfall during the last months of the year, was practically the same as in the previous year. There seems to be no doubt that this result was, at least partly, brought about by the inclusion of some of the deaths caused by fever under the head of "other diseases." Not since 1891 has the mortality from cholera been so great. The number of cholera deaths recorded was 778. The actual number was probably greater, as the fear that those attacked might be taken from their homes to hospitals seems to have led to concealment of the disease. The disinfection of those houses in which cholera was reported to have occurred was disliked by the people, and no doubt also contributed to concealment of cases. There were 116 deaths from small-pox, or two more than in 1897. Of 23 deaths which occurred amongst those who had previously been vaccinated, no fewer than 14 were deaths of children under 10 years of age. This mortality among children whose vaccination must have been comparatively recent, suggests the need for inquiry as to the genuineness of the lymph used and the fitness of the vaccinators. The percentage of success claimed in revaccination fell from 86·97 to 83·18, but is still very high, unless on the supposition that the primary vaccination of the cases was imperfect. Calf lymph is used in Madras, and in certain quarters of the city the calf is taken about with the vaccinator and the people vaccinated directly from it. Only 15 cases of plague, all of them imported, occurred in Madras city during the year. Elaborate preparations were made for combating the disease, but fortunately no indigenous cases followed those imported. No substantial advance was made during the year in the sanitary condition of the city. The Mylapur drainage scheme was, however, opened, and is said to be a great success. A satisfactory feature in connection with the drainage of Madras is the profitable utilisation of a portion of the sewage on farms. The chronic difficulty experienced in obtaining a sufficiency of labour for conservancy purposes has not yet been satisfactorily overcome.

29th May, 1900.

No. 15.

Memorandum by the Army Sanitary Commission on the Administration Report of the Municipal Commissioner for the City of Bombay for the Year 1898–99.

The Report of the Health Officer of the City of Bombay carries on the history of the plague epidemic which broke out towards the end of 1896, and continued to increase in fatality during the following year, and still more during the year under review. There is little that is new in the account given of the progress of the epidemic. Commencing with a record of 1,936 deaths in 1896, it was credited in the year following with 11,003, and now in the year under report with 18,185. Colonel Weir fervently hopes that 1898 will be the last of the abnormal cycle of years. His hopes have not been fulfilled, as will be only too evident when next year's history comes to be written. Nor was the Meteorological Reporter more happy in his forecast when he expressed the opinion "that the remarkable period through which India has passed had terminated, and a period of normal conditions was probable for two or three years." Colonel Weir mentions as a curious and important fact that the ground temperatures since 1896 have been rising at all depths, more or less, except in the cold season. This rise, five feet below the surface, was from 84·8° in 1896 to 86·3° in the year under review. Possibly, the rise may be in some way connected with variations in the amount of the rainfall; it is stated in the next paragraph that "the total rainfall for 1898 was 7·44 inches less

than in 1897 and 13·56 inches less than in 1896." Amongst other curious phenomena, Colonel Weir noticed that on the morning of the 6th of July the north part of the island was pervaded by a most offensive smell, tainting the air far and wide. This effluvium, he thinks, may have been due to the decomposition of dead rats ; for, he says, a number of bodies of rats were afterwards found in the suburbs. It was likewise noticed that during the epidemic of 1898 few mosquitoes were seen, and it seemed as if they had almost disappeared from the island. The disappearance of mosquitoes was again noticed in August. Whilst describing these and other unusual phenomena observed during the year, Colonel Weir does not attempt to suggest the existence of a connection between them and the course of the plague epidemic.

2. The course of the epidemic somewhat resembled that followed by it in the previous year. The rise in mortality which began in the middle of December, 1897, continued until, on the 9th of February, the plague deaths numbered 347. From the latter date, the level of mortality, although fluctuating, remained high until it attained its maximum in the middle of March, after which it rapidly fell until it reached its lowest point in June. Although it again irregularly rose until it reached a second climax in October, its fatality did not, until the end of the year, at all approximate that recorded in February and March. At the end of the year, the mortality curve was, however, again upwards. The diagram facing page 703 of the report admirably illustrates the course followed by plague throughout the year as compared with its course in 1897.

3. The measures adopted with the object of preventing the extension and lessening the fatality of the epidemic in Bombay, the Health Officer believes, have been successful in saving many lives ; but he confesses that "after three years of incessant activity against plague, the disease is more virulent and destructive in type than ever." At the same time, the returns show that in spite of the measures taken to prevent its extension, plague has effected an entrance into nearly every collectorate of the Presidency. The great danger in enforcing plague measures, Colonel Weir thinks, is that they may, if unpopular, excite general opposition and lead to concealment. Selecting, by way of example, a single day during the year, he estimates that on this day there were, out of a total of 264 deaths from all causes, 184 from plague. Of these 184, only 68 had occurred in hospitals ; the balance, 116, had therefore been concealed. No wonder that with such results the Health Officer was led to recommend "the abandonment of contact segregation, because it could not be carried out, however excellent in principle." The opening up of the houses by the removal of tiles from their roofs, the destruction of rats, the flushing with disinfectants of the buildings in which cases had occurred, the encouragement of inoculation against plague, as vaccination is used against small-pox, were the chief measures persevered with during the year 1898. Colonel Weir has to admit, however, that "the experience of this year indicates that the measures enforced in 1898 did not produce better results than the measures adopted in the previous year." Those who have faith in quarantine measures will be disappointed to learn from an officer who has seen more of plague than probably anyone living, that :—"Not a single restrictive measure on the movements of the population either stayed or even perceptibly influenced the epidemic" in Bombay.

4. The sanitary improvement of Bombay has naturally received a strong stimulus from the plague visitation. Much has been and is being done towards the completion of the drainage system of the city, but an immense amount of work still remains unfinished ; "for nearly one quarter of the area of the island has to be drained, and buildings by whole localities have yet to be drained and connected with sewers." A very important work, the removal of refuse outside the island of Bombay, has commenced. The question of overcrowding is one of the most difficult the authorities have to deal with. Colonel Weir seems to think the prevention of overcrowding to be well-nigh hopeless. He asks :—"Is there a single employer of labour in Bombay from the private individual to the master of a few servants, from the Municipalities to the Port Trustees, from the Port Trustees to any higher authority who is able to prevent over-crowding amongst their own servants"? Regarding the provision of proper houses for the poor, 100,000, or more, of whom now sleep on the damp ground, he adds :—"Take the most sanitary buildings in Bombay and allow the poor class to enter it, and in a few weeks they will make it as insanitary as the most insanitary chawl in the most insanitary area."

5. Anti-plague inoculation made some progress during the year. The total number of persons inoculated was 27,887. The degree of protection which inoculation affords against attack, and the extent to which it reduces the risk of a fatal result in case of attack, may not be known with precision, any more than the period of time during which it confers more or less immunity from attack ; yet the experience of those who have practised inoculation, supported by the opinion of the Plague Commission, favours the belief that, carried out under proper conditions, it exercises a powerful controlling influence over the disease. Still, if a previous attack of plague fails to confer complete protection against a second attack, it is scarcely probable that inoculation would be more successful. In paragraph 92 of his report, Colonel Weir describes a case which came under his own observation. The patient was inoculated in February : six months afterwards he suffered from plague, but recovered after having been two months in hospital. In November he had a second attack of plague and died in three or four days. In this case, which is surely most exceptional, neither inoculation nor an attack of plague, nor both together, prevented a second attack with a speedily fatal result. Surprise is expressed that a greater number of Europeans and Eurasians did not submit themselves to be inoculated ; but it is explained that these classes, living under the favourable hygienic conditions which surround them, think the risk of contracting plague so slight as scarcely to be worth the trouble of taking special means of protection against it. Observation seems to show that susceptibility to attack is less under than over five years of age, and that persons between 25 and 40 years are the most susceptible. The experience of another year confirms what was previously observed regarding the influence of ventilation in modifying plague mortality. "The mortality decreased with the height of the dwelling, being nearly 86 on the ground floor, over 77 on the first floor, 71 on the second floor, 61 on the third floor, 57 on the fourth floor, and 51 on the fifth floor."

6. Of the total number of 51,916 deaths in Bombay during the year, giving a ratio of mortality per thousand of population of 63·23, plague was of itself accountable for 18,185, or a ratio of 22·12. Both *cholera* and *small-pox* were in comparative abeyance, the former having attributed to it a death-rate of only ·12 and the latter of only ·06 per thousand. Nothwithstanding the unceasing combat with plague throughout the year, no interruption of the efficient working of the Vaccination Department was permitted. Last year the number of children successfully vaccinated under one year of age was 9,765; in the year under report the number was 9,050. In addition, 2,397 children under six years were vaccinated, and 150 persons who were upwards of that age. These figures show no great falling-off as compared with those of the previous year. Of re-vaccinations there were 1,062, of which only 230 were ascertained to be successful, 670 remaining "unknown." The number of live-births recorded during the year was 10,784. The mortality amongst children under one year of age was enormous. In the table at page 826 of the Report no fewer than 6,279 deaths of children under one year of age, exclusive of still-births, are recorded out of a total of only 10,784 live-births. Deducting the former from the latter figures, only 4,505 would remain available for vaccination; and of these a considerable number would probably, from various causes, be unfit to undergo vaccination. Such figures may well raise doubts as to the completeness of the registration of births. The proportion of still-births to children born alive continues, as heretofore, to be very high in Bombay; there were 1,569 of the former to 10,784 of the latter. If these figures can be relied upon it is striking to find that, in a city with a population, according to last census, of 821,704 inhabitants, there were only 10,784 children born alive, and that of this number 6,279 died within the year, leaving a residue of only 4,505 survivors. The plague epidemic is responsible, as Colonel Weir points out, for much that is abnormal in the birth and death rates.

7. The remaining chief causes of mortality during the year were *diseases of the respiratory system*, *phthisis*, and *fever*. The first of these are credited with 8,423 deaths, or 2,885 above the average. The excess suggests the record of a certain number of plague deaths under the head of respiratory diseases. Phthisis continues to be very fatal, 5,624 deaths having been attributed to it. The causes to which this great mortality is due in Bombay have been dealt with in former reports. They resolve themselves chiefly into bad ventilation and overcrowding. The causes suggest the remedy. The victims are, to a disproportionate degree, females, and especially those of the castes most prone to the seclusion of their women, Mussalmans and some high-caste Hindus. Compared with the mortality from phthisis in 1897, there was a decrease of 303 deaths, which Colonel Weir thinks "indicates one of two things, *i.e.*, either that there had not been great concealment of plague, or that the phthisical population had been reduced by plague." The mortality from fever was much less than in the previous year. To *enteric fever* 37 deaths were referred, being four more than in 1897 and seven more than the average. So small a number in a population of upwards of eight hundred thousand contrasts strikingly with the heavy mortality from the same disease among Europeans in India, notwithstanding the better sanitary environment of the latter. From *relapsing fever* 546 deaths were recorded; the disease had two periods of greatest prevalence, one occurring in March and the other in October. It will be seen that those two periods coincide with the two periods of maximum mortality from plague during the year. It was not always easy, even with a bacteriological examination, to differentiate the two diseases. During the previous year there was a serious increase in the fever mortality concurrently with the prevalence of cholera. In Madras the Sanitary Commissioner found, under similar conditions of cholera prevalence, that many deaths caused by cholera were registered under the head of "fever." Taking the whole year 1898, Colonel Weir observes that, although the mortality from fever rose and fell to some extent synchronously with the increase and decrease of plague mortality, this concurrent movement of the two diseases was less marked than it was in the previous year. The investigations of Ross, the Health Officer remarks, "suggest the necessity of studying the mosquito life of this island."

8. *Summary.*—The report is mainly a continuation of the history of the plague in the City of Bombay. In spite of the determined efforts to restrict its spread, cases of the disease were reported during the year from almost every collectorate in the Presidency. As the Health Officer puts it:—"After three years of incessant activity against plague, the disease is more virulent and destructive in type than ever." The number of deaths due to it in Bombay City increased from 11,003 in 1897 to 18,185 in the year under review. Concealment of cases continued to be one of the chief difficulties encountered in dealing with the epidemic. The Health Officer has recommended the abandonment of contact segregration, because it could not be carried out, however excellent in principle. Improving ventilation of houses by removing tiles from their roofs, flushing with disinfectants buildings in which cases of the diseases had been known to occur, and inoculation with anti-plague serum, were some of the measures on which reliance was placed in the combat with plague. The other chief diseases were not unusually prevalent. Cholera is credited with a death-rate of only ·12 *per mille* of population, and small-pox of ·06. The progress of vaccination was not interrupted by the campaign carried on against plague. The number of successful primary vaccinations fell but little short of the number in the previous year. The mortality from respiratory diseases rose to such a height as to suggest the record of cases of plague under this head. Phthisis, as usual, was very fatal, more especially amongst Mussalmans and some high-caste Hindus, classes of the population given to keeping their women secluded. The number of fever deaths rose and fell to some extent in sympathy with the rise and fall in plague prevalence, but to a less degree than in 1897. The differentiation of cases of relapsing fever from plague was sometimes difficult even with the aid of a bacteriological examination. Under the stimulus of the plague epidemic, sanitary measures in Bombay City were vigorously prosecuted. The drainage scheme is being actively proceeded with; but a vast amount of work remains to be finished before the scheme can be brought to completion.

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INDIA OFFICE,
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REPORT.

The present Report on Sanitary Measures in India during the year 1899 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1899.

The health of the European troops on service in India in 1899 was much more satisfactory than in the previous year. On an average strength of 67,697, the admissions into hospital were in the ratio of 1,149 per 1,000, against 1,437 in 1898, the daily sick-rate fell from 90 to 73, and the death-rate from 20·05 to 12·75. The invaliding ratio (32) was lower by 6 per 1,000, so that the total loss by death and invaliding was equal to 44 per 1,000, a decrease of 14 per 1,000 on the previous year.

The Presidential Army system was abolished in 1894, and the whole of the force in India is now designated the Army of India, divided into the Bengal, Punjab, Madras, and Bombay Commands. This organization took effect from the 1st April 1897.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands during 1899 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1898	20,060	1,184	96	19·54	44	64
	1899	21,278	1,191	81	13·82	36	50
Punjab	1898	18,388	1,558	90	27·63	40	68
	1899	18,080	1,085	62	14·82	24	39
Madras	1898	12,337	1,293	89	8·59	44	53
	1899	12,876	1,259	82	10·10	39	49
Bombay ...	1898	14,612	1,420	86	18·20	29	47
	1899	15,462	1,073	67	11·06	29	40
INDIA ...	1898	67,741	1,437	90	20·05	38	58
	1899	67,697	1,149	73	12·75	32	44

It will be seen from the above statement that in all the Commands, except that of Madras, there was a marked improvement in the health of the troops as compared with the previous year. In regard to mortality the improvement was greatest in the Punjab Command, its death-rate having fallen by nearly 13 per 1,000.

The chief causes of sickness in the whole European Army were, as in the year 1898, ague and venereal diseases, the former yielding a ratio of 235 per 1,000 against 394 in 1898, and the latter 313 per 1,000 against 363. Nearly a half (47 per cent.) of the total sickness resulted from these two causes. Enteric fever, as usual, was the chief cause of mortality, but the death-rate from it was only 5·14 per 1,000 against 10·17 in 1898. Over 40 per cent. of the total deaths were due to this cause.

Groups of stations.—The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,206	1,182	73	6·63
Burma, Inland	2,942	1,392	77	7·82
Bengal and Orissa	2,103	1,631	86	21·87
Gangetic Plain and Chutia-Nagpur	6,976	1,131	86	14·76
Upper Sub-Himalayan	12,749	1,226	75	14·12
North-Western Frontier, Indus Valley, and North-Western Rajputana.	4,781	1,115	59	15·06
South-Eastern Rajputana, Central India, and Gujarat.	6,151	1,131	78	14·96
Deccan	9,939	1,186	78	9·56
Western Coast	1,611	935	70	9·31
Southern India	3,194	1,354	80	14·40
Hill Stations	9,525	845	55	10·50
Hill Convalescent Depôts and Sanitaria ...	3,272	1,191	79	14·06

Of the above 12 groups, eight returned a higher daily sick-rate than that for the Army as a whole, and in seven groups the death-rate was greater. The most unhealthy group was Bengal and Orissa, with a daily sick-rate of 86 per 1,000 and a death-rate of 21·87, or about seven per 1,000 above its mortality (14·70) in 1898.

Of the stations with a strength of over 1,000, the highest death-rates were those of Peshawar (21·59), Lucknow (19·90), Umballa (17·39), and Bangalore (17·35). The first three were among the highest in 1898, but their ratios in 1899 were greatly reduced especially that of Peshawar, which was 48·95 in 1898.

Cholera.—There was again very little cholera in the European Army in 1898. Only one case, which proved fatal, was recorded against 17 cases and 14 deaths in 1898. "Never before in the records of this Office," the Sanitary Commissioner with the Government of India observes, "has so low a mortality appeared."

Small-pox.—Among the whole of the European troops in India there were during the year under notice 14 cases of small-pox with one death. In the previous year there were only 2 cases and no death.

Fevers.—From intermittent fever the admissions to hospital among the European troops in 1899 were in the ratio of 235 per 1,000 of strength, against 394 in the previous year. The death-rate was also lower, viz., 0·28 per 1,000, against 0·30 in 1898.

From enteric fever the admissions fell from 2,498 or 36·9 per 1,000 of strength to 1,392 or 20·6, and the deaths from 689 or 10·07 per 1,000 to 348 or 5·14. The reason for this great decrease "is to be found, perhaps," the Sanitary Commissioner states, "not so much in the climatic conditions of the year, as in the facts that the influx of drafts from England was much smaller than usual, and that there was no field service." Of the four Commands Punjab recorded the highest mortality under this head, viz., 6·64, followed by Bengal 5·50, Bombay 4·66, and Madras 3·03. Among the larger stations with an average strength of over 1,000, Peshawar returned a death-rate from this fever of 9·87, Meerut 9·31, Umballa 8·97, Allahabad 8·79, Lucknow 8·76, Chakrata 8·70, Mhow 8·37, Agra 8·23, Bangalore 7·43, and Rawalpindi 7·37, and in the remaining large stations the death-rate ranged from 4·85 in Rainkhet to 0·91 in Fort William and *nil* in Fort Dufferin (Mandalay). As usual, young and unacclimatised soldiers were the chief sufferers; among those from 20 to 25 years of age the death-rate was 7·59 per 1,000,

against 13·46 in 1898, while among men between 25 and 30, and from 30 to 35, the mortality was 3·08 and 1·72 per 1,000 respectively. Among men of less than one year's residence in India the death-rate from this fever was 11·72 per 1,000, among men between one and two years 6·81, and among men between five and ten years' service 2·63 per 1,000. Of the total 348 deaths from enteric fever, 73 per cent. occurred among men between the ages of 20–25, and 41 per cent. during the first year of residence in India.

Bowel Complaints.—The admissions from dysentery and diarrhœa among the European troops were in the ratio of 43 per 1,000 of strength, or 14 per 1,000 less than in 1898. The mortality from dysentery was in the ratio of 0·65 against 0·78 in the previous year, and from diarrhœa *nil* against 0·04. Dysentery was most prevalent, as usual, in the Bengal Command.

Abscess of the Liver.—From abscess of the liver there were 85 deaths, yielding a ratio of 1·26 per 1,000 of strength, against 1·52 in 1898.

Plague.—There were seven cases of plague among the European troops, and two of them were fatal, against nine cases and two deaths in 1898.

Venereal Diseases.—Venereal diseases ranked first in the list of causes of admission to hospital, and also in the causes of invaliding. They were the cause of 27 per cent. of the total sickness during 1899, and of over 20 per cent. of the invaliding of the European Army of India. The admission-rate from venereal diseases per 1,000 of strength was 313·4, or 49·5 per 1,000 below that of 1898, and 208 per 1,000 less than the maximum rate (522·3) recorded in 1895, "a practical proof," the Army Sanitary Commission remark, "of the success of the sanitary measures recently enforced with the object of preventing these diseases from spreading amongst our young soldiers in India." All four commands shared in the decrease, but it was most marked in Bombay and Bengal. The Madras Command returned the highest rate, viz., 397·8 per 1,000 against 438·3 in 1898. Bengal came next with a ratio of 364·9 against 437·9, Bombay with 273·6 against 352·5, and the Punjab with 226·7 against 268·9. The number of men constantly sick in hospital from these diseases was 1,851, against 2,202 in the previous year, being equivalent to about two regiments; and the average stay of a case in hospital was 32 days. The deaths from these diseases numbered 14, and the invalidings 442, against 17 and 569 respectively in 1898.

Invaliding.—The loss to the whole army by invaliding during 1899 amounted to 2,142 men, equal to 31·64 per 1,000, against 2,580 or 38·09 in 1898. The proportion of invalids to strength was highest in the Madras Command (38·7), followed by Bengal (35·7), Bombay (29·2), and Punjab (23·9). Of the total number invalided, 31 per cent. were discharged as unfit for further service, being 3 per 1,000 higher than in 1898. As regards the influence of age and length of residence in India upon invaliding, 59 per cent. of the total number invalided were under 25 years of age, against 62 in 1898, while 38 per cent. were of less than two years' service, and 81 per cent. were of less than five years' service. In the European Army of India as a whole 78 per cent. of the total strength had seen less than five years' service.

II.—NATIVE ARMY.

Sickness and Mortality in 1899.—The health of the Native Army of India was also better than in 1898.

The ratios of sickness and mortality among Native troops in the five Commands during 1899 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1898	25,036	767	35	10·03
	1899	26,820	716	29	10·03
Punjab	1898	42,515	942	35	13·38
	1899	44,224	731	27	12·48
Madras	1898	22,575	683	30	9·92
	1899	23,255	672	30	9·03
Bombay	1898	24,520	870	31	7·79
	1899	26,657	699	26	10·69
Hyderabad Contingent	1898	6,304	474	17	5·08
	1899	6,556	430	15	6·86
INDIA	1898	126,036	816	33	11·07
	1899	128,529	705	28	10·70

Of the five Commands the Punjab as usual returned the highest rate of mortality, though the ratio was slightly lower than that for 1898. Pneumonia was again very prevalent in this force, and the death-rate from it was 5·83 per 1,000, or nearly a half of the total mortality.

The chief cause of sickness in the Native Army was ague, which caused 37 per cent. of the total admissions. Among the diseases from which the admissions to hospital were higher than in 1898 were influenza, cholera and small-pox ; while from enteric and other fevers, respiratory diseases, bowel complaints, venereal diseases, &c., there was a decrease in the admissions. From influenza the admission-rate rose from 8·3 per 1,000 of average strength in 1898 to 12·3. From venereal diseases the admission-rate in the Native Army was only 34·1 per 1,000 of strength, as compared with 313·4 per 1,000 among European troops. Figures under this head are not available for the years before 1877. The ratios run at a much lower level than those of European troops, and they have remained comparatively steady during the 23 years, the ratios varying from 27·4 to 41·1.

Pneumonia was the chief cause of death in the Native Army, and no less than 36 per cent. of the total deaths were due to it. The death-rate under this head was 3·86 per 1,000 of average strength, against 3·77 in 1898. From this disease the mortality among the Native soldiers was nearly six times as great as that among European troops (0·66 per 1,000). Fevers of all kinds were the cause of 17·8 per cent. of the total deaths, against 44·0 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 1·89 per 1,000, while among the European troops the proportion was 0·46. On the other hand, the death-rate from enteric fever among the Native troops was only 0·02 per 1,000, as compared with 5·14 among the European troops.

From cholera there were 68 deaths in the Native Army, equal to 0·53 per 1,000 of strength, as compared with 42 or 0·33 in 1898.

During 1899 there were 76 cases of plague among the Native troops with 45 deaths, against 94 cases and 58 deaths in 1898.

Groups of stations.—The following statement gives the principal statistics of the Native Army, arranged in geographical groups, for 1899 :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,389	887	36	7·20
Burma, Inland	4,257	995	38	9·40
Assam	1,490	964	43	6·71
Bengal and Orissa	2,867	1,481	42	9·77
Gangetic Plain and Chutia-Nagpur	6,166	545	26	7·78
Upper Sub-Himalayan	15,555	554	24	9·90
North-Western Frontier, Indus Valley, and North-Western Rajputana.	16,269	839	32	15·31
South-Eastern Rajputana, Central India, and Gujarat.	12,522	583	22	6·71
Deccan	19,410	618	22	9·43
Western Coast	3,306	755	30	9·98
Southern India	8,075	597	33	7·55
Hill Stations	18,339	880	39	15·54

In eight of the 12 groups the daily sick-rate was higher than that for the whole Native Army, and in two the mortality was greater. In the previous year the highest mortality was recorded by the Assam group, viz., 27·15, of which cholera contributed 8·4 ; while in 1899 this group returned a death-rate of 6·71, cholera being entirely absent.

Of the large stations with a strength of over 1,000, the following recorded the highest death-rates :—Edwardesabad 28·04, Peshawar 16·19, Dera Ismail Khan 16·27, Belgam 15·24, and Mardan 10·96. The chief cause of death at these five stations was pneumonia.

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III.—GENERAL POPULATION.

The year 1899 was generally a healthy one, though the failure of the monsoon rains in Western and Central India changed the climatic conditions of the last quarter for the worse, and terminated the prosperity which the two previous years had established.

Vital statistics.

Births were registered throughout all the 10 provinces in India in 1899, and the birth-rates varied between 50·5 and 25·6 per 1,000 of population under registration. All the provinces returned a higher birth-rate than in 1898, the improvement being attributed chiefly to their having recovered from the effects of the famine and scarcity of 1896–97, and to the healthiness and prosperity of 1898. The highest rates were recorded in Berar, the Punjab, the North-Western Provinces and Oudh, Central Provinces, Bengal, and Lower Burma, their respective rates being 50·5, 48·4, 48·1, 47·3, 42·9, and 37·0. In the remaining provinces the birth-rates ranged between 36·4 in Bombay and 25·6 in Coorg. The birth-rates exceeded the death-rates in all the provinces except Coorg, the excess per 1,000 varying between 19·26 in the Central Provinces and 0·7 in Bombay. The recorded deaths rose from 5,676,833 or 26·56 per 1,000 of registered population in 1898 to 6,418,409 or 29·95. The year 1898, however, was extraordinarily healthy, and the 1899 death-rate of 29·95 compares favourably with earlier years of the decade. Compared with 1898 the increase in mortality in 1899 was due to the greater prevalence of all the chief diseases except small-pox. In six of the ten provinces the mortality was higher than in the previous year. Cholera deaths rose from 151,509 to 169,236. The increase was confined to five provinces, but only three recorded cholera death-rates of over 1 per 1,000, viz., Assam 1·66, Bengal 1·51, and Lower Burma 1·11. The rise in the deaths from fevers by 355,784 was confined to five provinces, viz.: Bengal, North Western Provinces and Oudh, Central Provinces, Bombay and Berar. In connexion with this cause of death the scheme for the sale of quinine at a low price by postal agency does not on the whole appear to have achieved much success during the year.

The deaths from the chief diseases and from all causes in the several provinces were as follows:—

	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1899.	1898.
Bengal	107,678	1·51	13,116	0·18	1,607,279	22·61	41,334	0·58	2,218,243	31·21	26·57
North-Western Provinces and Oudh.	8,142	0·17	2,096	0·04	1,245,260	26·55	27,206	0·58	1,556,821	33·19	27·38
Punjab	1,816	0·09	5,149	0·25	381,689	18·57	13,410	0·65	607,725	29·57	31·05
Central Provinces	76	0·01	1,511	0·14	168,326	15·98	13,489	1·28	291,054	27·65	24·30
Lower Burma	4,942	1·11	5,891	1·32	51,177	11·47	8,071	1·81	121,771	27·30	26·13
Coorg	—	—	28	0·16	3,998	23·10	110	0·64	4,845	28·00	31·44
Assam	8,380	1·66	1,565	0·31	91,096	18·04	13,835	2·74	156,595	31·01	36·15
Madras	29,082	0·9	16,991	0·5	245,549	7·3	31,307	0·9	675,094	20·1	21·0
Bombay	8,579	0·46	1,946	0·10	228,438	17·27	74,736	3·97	672,269	35·72	29·16
Berar	541	0·2	305	0·1	49,938	17·5	20,263	7·1	113,992	39·9	23·4
Total	169,236	0·79	48,598	0·23	4,072,750	19·05	243,761	1·14	6,418,409	29·95	26·56

Bengal.

The general health of Bengal in 1899 was slightly above the average. The number of births registered in the province rose from 2,543,701 or 35·79 per 1,000 of population in 1898 to 3,053,178 or 42·96, the latter being made up of district rates varying from 53·28 in Palamau to 30·17 in Hooghly and 16·14 in Calcutta. Of the 46 districts there was an increase of births in all except Jalpaiguri, Rajshahi and Jessore, the greatest advance being in Hazaribagh, where the ratio was 18·09 per 1,000 in excess of the previous year. Three districts returned a birth-rate of over 50 and 29 of over 40 per 1,000, the highest, as already stated, being 53·28 in Palamau. Calcutta, as usual, returned the lowest birth-rate, but the sudden drop in 1898 noticed in last year's report as being probably due to an exodus of women from fear of plague, was almost counterbalanced by the rise from 13·98

to 16·14. Twenty-six towns returned a birth-rate in excess of 40 per 1,000, while 116 rural areas recorded rates of over 50 per 1,000, and 131 others over 45 per 1,000. These figures are considerably in excess of those of the three preceding years, and show how widely distributed was the increase in the general birth-rate for the province.

The total number of deaths registered during the year under notice was 2,218,243 or 31·21 per 1,000, as compared with 1,888,468 or 26·57 in 1898. There was thus an excess of births over deaths of 834,935 or 11·84 per 1,000. The district death-rates ranged from 50·75 in Malda to 19·97 in Singhbhum. In urban areas the rate of mortality rose from 27·50 to 33·10, which was made up of ratios varying from 69·18 in Puri to 12·07 in Manicktolla. In rural areas the average death-rate rose from 26·52 to 31·11. The death-rate, though much higher than that recorded for 1898, was lower than that of any of the four years which preceded it.

From all the principal diseases except small-pox the mortality was higher than in 1898. Cholera prevailed with greater intensity, and the deaths rose from 65,020 or 0·91 per 1,000 to 107,678 or 1·51, which was the second lowest death-rate from the disease on record for 14 years. No district entirely escaped the disease, and it attacked 17,217 villages against 11,307 in the previous year. Of individual districts the mortality was highest in Malda (6·28 per 1,000), followed by Puri (4·59), and Bogra (4·45). The high rate of mortality in Puri was chiefly due to a severe outbreak of the disease among the pilgrims during the Rath Jatra festival in July. As regards the seasonal incidence of the disease, the mortality was highest in the last three months of the year, and lowest in June, February, March and July.

From small-pox the deaths fell from 14,269 or 0·20 per 1,000 in 1898 to 13,116 or 0·18 in 1899. The disease was present in all the districts except Jalpaiguri and Pabna, the former having now been free from this scourge for three years in succession. The only districts in which it can be said to have prevailed in an epidemic form are Puri and Cuttack, with death-rates of 3·93 and 2·45 respectively. In no other district did the death-rate under this head reach 1 per 1,000.

About three-fourths of the total deaths were recorded under fever. The mortality, although higher than in 1898, was lower than in any of the four preceding years. The number of deaths reported to have occurred from fever during the year was 1,607,279 or 22·61 per 1,000 of population, against 1,479,483 or 19·97 in 1898. Out of the 46 districts, 20 recorded a higher fever mortality than the provincial rate, eleven registering a rate of over 30 per 1,000. Malda ranked first with a rate of 41·68, followed by Dinajpur 37·50, Faridpur 37·32, and Rajshahi 36·23, all of which, besides 35 others, showed an increase on the previous year's figures. In 29 out of the 39 districts which returned a higher fever mortality, there was a corresponding increase in the sale of quinine. In the two previous years there had been a considerable falling off in the sale of quinine packets, but in 1899 there was an increase of 8,423 on the number sold in 1898.

From dysentery and diarrhœa the mortality was somewhat larger, 41,334 deaths having been registered, equal to 0·58 per 1,000 of population, against 37,158 or 0·52 in the previous year. The increased prevalence of the disease, Dr. Dyson observes, was probably due, to some extent, to the causes which led to increased cholera in many districts, viz., early cessation of the rains and the early pollution of the water supply. The incidence of the disease was higher than that of the preceding year in 29 districts out of 46, lower in 15, and the same in two districts.

Plague was present in the province throughout the year, and the total mortality recorded from it was 3,264. All the deaths with the exception of 583 occurred in Calcutta. In all places, it is stated, the first patient was found to have come from Calcutta. The largest number of deaths in any one district (132) was reported from Saran.

In Calcutta the birth-rate was higher than that of 1898, viz., 16·14 against 13·98. The registered deaths numbered 25,823 or 37·8 per 1,000 of population, against 20,343 or 29·08 in the previous year. There was an increase in mortality under all the chief death causes except small-pox, from which there were only 62 deaths against 85 in 1898. Cholera deaths rose from 665 to 990, of which 107 or 10·8 per cent were imported from places beyond the limits of Calcutta, and 101 or 10·2 per cent. were pilgrims on their way home from Puri. The deaths from fever rose from 6,160 or 8·8 per 1,000 to 7,173 or 10·5. From plague 2,681 deaths were registered in the city against 192 in 1898.

North-Western Provinces and Oudh.

In the North-Western Provinces and Oudh the general sanitary conditions of 1899 were not up to the standard of the preceding year, but were well above the decennial average. During the year 2,255,627 births were recorded, being equal to 48·09 per 1000,

against 1,751,725 or 37·35 in the previous year. The birth-rate of the year is the highest on record, the rate previously highest being 43·77 in 1884. Of the total 48 districts 24 showed a birth-rate above and 24 below the average of the provinces. Bulandshahr, as usual, headed the districts with a birth-rate of 63·48, followed by Etah 61·44, Budaun 59·24, Muzaffarnagar 55·97, Hardoi 55·51, Aligarh 55·14, Farukhabad 54·90, and Bareilly 54·86. The birth-rate in municipalities was 47·24, against 36·44 in the previous year, and was made up of extremes ranging from 67·99 in Kandhla to 11·58 in Mussoorie.

The number of deaths registered was 1,556,821 or 33·19 per 1,000 of population, against 1,284,319 or 27·38 in 1898. The provincial death-rate, which was made up of district rates ranging from 41·93 in Mainpuri to 21·24 in Banda, was exceeded in 28 districts. The urban death-rate was 39·04 against 33·41 in 1898. Out of 104 municipalities only 18 recorded more deaths than births. Registration was again tested by local authorities, and the results disclosed an omission of 2·67 per cent. on 255,170 births, and 2·38 on 185,216 deaths; and in cases tested by the Vaccination Department the omitted percentages were 0·66 of births and 0·41 of deaths.

Cholera was more prevalent than in 1898, but with the single exception of that year the mortality was the lowest recorded since 1881. The total deaths from the disease numbered only 8,142 or 0·17 per 1,000, against 2,508 or 0·05 in 1898. Garhwal recorded the highest district rate of 1·61, followed by Fyzabad 1·19, and Dehra Dun 1·16, these being the only cases in which the death-rate exceeded 1 per 1,000. Four districts were entirely free from the disease, and no outbreak occurred at any of the large fairs. Out of a total of 107,239 villages only 1,049 were visited by cholera. The mortality was lightest in January (27 deaths), and heaviest in August (1,650). The disease declined in September, and in December 734 cholera deaths were reported.

The absence of small-pox was even more marked than in 1898, the mortality having fallen from 2,419 or 0·05, to 2,096 or 0·04, which is the lowest rate recorded since 1871, when trustworthy registration began. No high rates were reported in the districts, and three escaped the disease altogether. Hardoi and Gonda headed the districts with 0·17 each, and among towns Mallawan in the former district came first with 0·76.

The mortality from fever in 1899 was much higher than in the previous year, the number of deaths having risen from 1,063,596 or 22·67 per 1,000 to 1,245,260 or 26·55. Among the districts, Mainpuri came first with a fever death-rate of 40·09, followed by Farukhabad 37·75, Naini Tal 37·32, Muttra 35·89, Budaun 35·40, and Bulandshahr 35·23. Nineteen other districts recorded ratios above the provincial rate. The mortality reached its maximum in September and the minimum was in February. In addition to the sale of quinine at a low price by postal agency a scheme was under the consideration of Government for its sale through landholders and other non-official agency.

The deaths from dysentery and diarrhœa rose from 23,574 or 0·50 per 1,000 in 1898 to 27,206 or 0·58. Among districts, Garhwal again recorded the highest ratio of 8·79, followed by Almora 5·17, Dehra Dun 3·35 and Benares 2·11. In 12 other districts the provincial rate was exceeded.

The provinces were almost free from plague during the year, only seven deaths having occurred in Allahabad district. In the previous year 148 deaths were reported in the provinces.

Punjab.

The year 1899 in the Punjab was again a healthy one. The number of births registered was 994,001 or 48·4 per 1,000 of population, as compared with 841,869 or 41·0 in 1898. The birth-rate was again higher than that of any other province in India, and was made up of district ratios ranging from 69·1 in Jhang to 21·7 in Simla, and 30·4 in Peshawar. In 12 other districts the birth-rates ranged between 61·2 and 50·3 per 1,000. These high birth-rates are attributed chiefly to under estimation of the increase in population since the last census, to improved registration, and to the general healthiness of the preceding year. In 14 districts the birth-rate exceeded the provincial rate, and 13 other districts recorded ratios between 48·3 and 40·5 per 1,000. The provincial birth-rate exceeded the death-rate by 19 per 1,000 of population; in one district (Gujranwala) the excess was over 30 per 1,000; in 13 over 20 per 1,000, and in seven other districts the increase of births over deaths ranged between 15 and 18 per 1,000.

From all causes 607,725 deaths were registered, giving a death-rate of 29·57, against 638,124 or 31·05 in 1898. The highest district rates were reported from Jhang 41·6,

Karnal 35·3, and Gurgaon 35·0 ; the remainder varied between 34·4 in Delhi and 20·3 in Montgomery.

The province was practically free from cholera in 1898, only 33 deaths having been recorded, but in the year under notice the disease appeared in several districts, causing a mortality of 1,816, or 0·09 per 1,000 of population. More than half the deaths were contributed by Shahpur (702) and Hissar (308). Ten of the 31 districts were entirely free from the disease, and in six others only one or two deaths were recorded in each. Not a single cholera death occurred during the first three months of the year, and only four during the next three months. In July there were 71 fatal cases, followed by 433 in August ; there was a falling off till December, when the maximum number of 906 was registered. The disease was confined to 127 villages out of a total of 38,548.

Small-pox caused a mortality of 5,149 and a death-rate of 0·25, against 4,998 or 0·24 in 1898. All the districts were affected except Simla, but the disease was severe only in Peshawar, which is the least vaccinated district in the province, and which contributed no less than 2,288 deaths, giving a death-rate of 3·37 per 1,000. The mortality was excessive in the town of Peshawar, which recorded 770 deaths, being at the rate of 12·21 per 1,000. Of the total 5,149 deaths from this disease, all but 382 were children between the ages of 1 and 10.

The mortality from fevers was less than in 1898, though it was as usual severe. The deaths numbered 381,689, equal to a death-rate of 18·57 per 1,000, against 418,206 or 20·35 in 1898. The provincial rate was exceeded by 14 out of the total 31 districts, the highest being Jhang 24·06, Karnal 23·64, and Gurgaon 23·29.

From dysentery and diarrhœa the deaths fell from 15,747 or 0·77 in 1898 to 13,410 or 0·65. Thirteen districts recorded a higher mortality under this head than the provincial rate, the highest being Gurgaon 1·38, Simla 1·31, Kangra 1·30, Delhi 1·29, Hissar 1·12, Hoshiarpur 1·05, and Gurdaspur 1·03.

Plague was present in the province during the year and 255 deaths were recorded, against 1,951 in the previous year. Only four districts were affected, viz., Jullundur, Hoshiarpur, Rawalpindi, and Amritsar, but the disease was chiefly confined to Jullundur.

Central Provinces.

The year 1899 was again a very healthy one in the Central Provinces. The recovery of the people from the effects of the famine noticed in the previous year was continued in 1899. A total of 497,419 births was registered, being equal to 47·35 per 1,000 of population, against 313,116 or 29·75 in 1898. The increase was distributed over all the 20 districts ; and in all there was an excess of births over deaths ranging from 13·51 in Balaghat to 26·08 in Murwara. By districts the birth-rates ranged from 60·06 in Burhanpur to 38·58 in Saugor. The provincial birth-rate was exceeded in eleven districts.

The deaths during the year numbered 291,054 or 27·65 per 1,000, against 246,360 or 24·30 in 1898, which was an exceptionally healthy year. Still the mortality in 1899 was below that of any year in the past decade, except 1893 and 1898. In the last quarter of the year, when famine again declared itself, the mortality was less even than in the preceding healthy year. The provincial death-rate was exceeded in eleven districts, with ratios varying between 46·15 in Burhanpur and 27·88 in Bhandara ; in the remaining eight districts the death-rates ranged from 27·20 to 23·05.

There was again very little cholera in the provinces during the year, only 76 deaths having been recorded against seven in 1898. One death occurred in April and one in October, and 10 in November and 64 in December in Nimar district and the neighbouring Burhanpur sub-division. In each of the two previous years (1897 and 1896) over fifty thousand cholera deaths had been registered.

Small-pox was slightly more prevalent than in the previous year, and the deaths rose from 1,149 or 0·11 per 1,000 in 1898 to 1,511 or 0·14. The disease affected every district but two (Narsinghpur and Burhanpur), but only in one district did the death-rate reach 1 per 1,000, viz., Sambalpur, with 1·16. Of the total small-pox deaths 431 occurred among infants and 462 among children between one and 10 years of age.

The deaths ascribed to fevers numbered 168,326 or 15·98 per 1,000 of population, against 164,999 or 15·68 in 1898. The number of deaths and the death-rate were both much less than in any of the previous years from 1891, except 1898. The provincial death-rate from fever was exceeded by eleven districts, with ratios ranging from 37·40 to 16·15.

From dysentery and diarrhœa the registered mortality rose from 13,038 or 1·24, per 1,000 of population in 1898 to 13,489 or 1·28. The lowest death-rate under this head

was again recorded by Bhandara district (0·09), and the highest by Sambalpur (4·63). The other districts with relatively high rates were Wardha (4·17), Jubbulpore (2·01), and Burhanpur (1·98).

During the year there were 584 deaths from plague against 131 in 1898. Only two of the deaths were imported cases, the rest being indigenous. The disease did not succeed in establishing any firm hold in the provinces, as attacks were confined to the two districts of Nagpur and Wardha. Precautions were taken to prevent the disease spreading, and arrangements were everywhere made to cope with it in the event of its appearance.

Burma.

Registration of vital statistics continues to make steady progress in Burma. Births and deaths continued to be recorded in Lower Burma and registration has now been extended to 13 municipal towns in Upper Burma. Registration of deaths was introduced in selected districts in Upper Burma in the beginning of 1899, but it has been decided not to attempt for the present the registration of births. In the area under registration in Lower Burma 165,229 births were recorded in 1899, giving a birth-rate of 37·04 per 1,000 of population, as compared with 153,838 or 34·11 in 1898. That there is still much room for improvement is shown in the variations in the district rates, which ranged from 46·08 in Pegu to 17·55 in Rangoon. The number of deaths registered was 121,771, representing a death-rate of 27·30 per 1,000 of population, against 117,856 or 26·13 in 1898. By districts the ratios ranged from 20·55 in Akyab to 44·03 in Rangoon.

Cholera in an epidemic form prevailed throughout each month of the year and caused 4,942 deaths or 1·11 per 1,000 of population, against 2,972 or 0·66 in 1898. All the districts were visited by the disease except Toungoo. Mergui suffered more than any other district, and recorded a cholera mortality of 5·04 per 1,000, followed by Amherst with 2·47 and Myaungmya with 2·08. Seven per cent of the 16,757 villages were affected, against 4 per cent in 1898. The months of greatest mortality were April, May, and August.

Small-pox was more fatal than in 1898, the deaths having risen from 4,826 or 1·07 per 1,000 to 5,891 or 1·32, this being the highest mortality recorded since 1884. Of the 5,891 deaths, 686 or 11·6 per cent. were infants and 2,286 or 39 per cent. were children over one and under 10 years of age. The Pegu division again suffered most, its five districts returning 3,013 deaths, of which Rangoon contributed 919 or 5·10 per 1,000 of its population. The provincial average was exceeded in six other districts with rates varying between 2·61 and 1·43. Akyab district was free from small-pox during the year, and only two deaths were returned by Mergui.

Deaths ascribed to fever fell from 53,697 or 11·90 per 1,000 in 1898 to 51,177 or 11·47, which was made up of district rates ranging from 18·02 in Sandoway to 7·40 in Hanthawaddy. In ten other districts the provincial rate was exceeded. The town death-rate from fever was 8·12, and the rural rate 11·97, as compared with 8·23 and 12·45 respectively in 1898. In only five towns was the mortality above the average for the province, Myungmya coming first with 30·04, followed by Sandoway with 15·80.

The deaths registered under dysentery and diarrhœa during the year aggregated 8,071, or 39 more than in 1898, the death-rates being 1·81 and 1·78 per 1,000, respectively. By districts the highest mortality under this head was recorded by Tavoy 5·45, followed by Thaton 5·34, Mergui 4.75, and Rangoon 3·99; in the remaining 14 districts the death-rates ranged from 2·07 to 0·86.

Assam.

Registration of vital statistics is still imperfectly carried out in Assam. The total number of births registered during the year 1899 was 179,027, giving a ratio of 35·45 per 1,000 of population, as compared with 148,956 or 29·46 in 1898. The improvement was more marked in the two districts of the Surma Valley (Cachar and Sylhet), and "affords further proof" the Sanitary Commissioner reports, "that the people have recovered from the frightful malarial fever which did so much harm in 1897." The highest birth-rate was again recorded by Goalpara district, viz., 41·43, followed by the Garo hills (selected areas) 41·23, Cachar 39·35, Sylhet 38·02, and Lakhimpur 37·72, these being the only five instances in which the provincial rate was exceeded, as the rates of the remaining districts ranged from 34·43 in Darrang to 21·01 in Nowgong.

On the whole there was a marked improvement in the health of the province, and the registered deaths fell from 182,763 or 36·15 per 1,000 of population in 1898 to 156,595, to 31·01 per 1,000. No district except Darrang registered so high a death-rate as in the previous year. In the Surma Valley, comprising the districts of Cachar and Sylhet, the average mortality fell from 37·29 to 30·53, and in the Brahmaputra Valley the average death-rate was 31·01, as compared with 36·17 in the previous year. Of the six districts

in this division Darrang recorded the highest mortality of 44·86 per 1,000, the ratios of the remaining five districts ranging from 38·83 to 23·58. Taking the province as a whole an excess of births over deaths to the extent of 4·44 per 1,000 was reported, whereas in the previous year the death-rate exceeded the birth-rate by 6·69.

The mortality from cholera was still less than in 1898, the number of deaths being 8,380 or 1·66 against 11,288 or 2·24 in 1898. The disease prevailed throughout the year and visited every district. The highest district cholera death-rate was recorded by Goalpara (5·05 against 1·86 in 1898) in the Brahmaputra Valley, followed by Kamrup and Darrang whose rates were respectively 2·08 and 1·70. The average death-rate from cholera in the towns was 1·71 per 1,000, against 1·66 in rural areas. Among tea-garden coolies who travelled up the Brahmaputra Valley in steamers there were 21 deaths from cholera, against 26 in 1898; and among the coolies at the depots, after landing, there where 51 deaths, against 58.

The mortality from small-pox was much less than in the previous year, the deaths numbering only 1,565 or 0·31 per 1,000, against 5,208 or 1·03. No less than 80 per cent. of the deaths occurred in the Brahmaputra Valley districts, where there is still a very strong objection to vaccination. Out of 1,258 small-pox deaths in these districts, Darrang contributed 946 or 3·07 per 1,000 of population. The next highest mortality was in Khasia, and Jaintia Hills, viz., 2·24. In no other district did the death-rate from this cause reach 1 per 1,000. Of the total small-pox deaths, over 65 per cent. occurred among children under 10 years of age.

More than a half of the year's mortality was ascribed to fevers, including kala-azar. The number of deaths registered from these causes was 91,096, representing 18·04 per 1,000 of the population, against 105,811 or 20·95 in 1898. The decrease was chiefly in the Surma Valley, where the death-rate fell from 18·59 to 14·83. Of the 91,096 fever deaths 14,246 were from kala-azar against 16,472 in 1898. The provincial fever death-rate was exceeded by four districts, Goalpara ranking first with a rate of 30·11. As in previous years, the bulk of the kala-azar deaths occurred in Nowgong district, but there was a marked improvement on the previous year's figures, the number of deaths having fallen from 10,515 to 8,192. In Darrang the mortality under this head remained about the same (4,101), while Kamrup showed a slight increase (1,745 against 1,693). On the whole, the Sanitary Commissioner states, the epidemic may be said to be surely if slowly ceasing.

The improvement in general health is also shown by the decreased number of deaths from dysentery and diarrhœa, the figures having fallen from 16,239 or 3·23 per 1,000 of population to 13,835 or 2·74. The district rates presented the same extraordinary and unaccountable differences as in former years. Thus in Goalpara the rate was 0·33, and in Kamrup and Nowgong 1·09, while in Darrang, Sibsagar and Lakhimpur the rates were 4·44, 5·65, and 7·70 respectively. The difference however was thought to be more apparent than real and to be caused by differences in registration.

Madras.

The number of births registered in Madras Presidency during the year was 1,048,335 or 31·3 per 1,000, against 911,747 or 27·4 in 1898. The increase was attributed partly to better registration and partly to the natural tendency to an increase of birth-rate among the population inhabiting the districts which had suffered from famine during the preceding years. The rates for urban and rural areas were 35·7 and 30·9 against 33·0 and 26·9 respectively in the previous year. With a view to improvement in rural areas, an Act entitled the Madras Registration of Births and Deaths Act was passed during the year and is at first to be worked tentatively in selected rural areas. Kistna district registered the highest ratio of 40·5, and in twelve other districts the rate was above 30 per 1,000; in all but five of the 22 districts there was an increase in the birth-rate.

The mortality in 1899 was less than that of the previous year by 24,014, the deaths having fallen from 699,108 or 21·0 per 1,000 to 675,094 or 20·1. By districts the highest death-rate (38·5) was recorded in Madras City, though it was nearly 7 per 1,000 lower than that recorded in the previous year. In the other districts the mortality ratios ranged from 29·9 per 1,000 in South Canara to 14·4 in Ganjam. The Sanitary Commissioner (Dr. King) remarks that "it is hopeless to attempt, under existing circumstances of registration, to criticise the death-rates reported from districts. They may possibly sink to the almost certainly ridiculous rate of 14·4 per 1,000 in Ganjam, or rise to nearly 30 per 1,000 in South Canara without its being possible to state definitely what are the errors of omission and commission. The only criterion available is the approach to accuracy of the birth-rate, and the acknowledged existence of special diseases. One cause of deficient death-rate is certainly a tendency to ignore the deaths of infants below one year of age."

Of the chief diseases, cholera showed a further decline, the number of deaths having fallen from 65,444 or 2·0 per 1,000 to 29,082 or 0·9. All the districts but two (Kurnool and Nilgiris) were affected. In three other districts the deaths did not exceed 20 altogether. The disease was most severe in Salem, Tanjore, and Trichinopoly, which recorded cholera death-rates of 2·8, 2·6, and 2·4 respectively. In the remaining districts the rates varied from 1·9 in South Arcot to 0·01 in Anantapur. The average death-rate in municipal and other towns from the disease was 1·5 per 1,000, against 2·1 in 1898, and that in rural tracts 0·8, against 2·0. Twenty-eight of the municipalities were free from cholera, while three recorded death-rates over 10 per 1,000, and four over 5 per 1,000.

Small-pox deaths were reported from all the districts, and the total in the whole Presidency aggregated 16,991 or 0·5 per 1,000, against 20,490 or 0·6 in 1898. Of the districts, South Arcot was the only one in which the mortality exceeded 1 per 1,000 (1·2). It is satisfactory to observe that Ganjam returned only 489 deaths from the cause, against 10,838 in the previous year. Of the total small-pox deaths, 5,702, or 33½ per cent., occurred amongst children under 1 year of age, and 5,286, or 31 per cent., among those between 1 and 10 years of age.

From fevers the registered deaths fell from 248,638 or 7·5 per 1,000 of population in 1898 to 245,549 or 7·3. Dr. King attributes the reduction partly to the imperfect character of the north-east monsoon and the consequent absence of the usual degree of moisture in the soil, and partly to a tendency on the part of those giving information regarding deaths to escape suspicion of a disease whose prominent symptom is fever, namely plague. In ten districts, however, the fever death-rate was higher than in the previous year. Seven districts had death-rates of over 10 per 1,000, and six of over 5 per 1,000. Six of the 59 municipal towns returned fever death-rates exceeding 10 per 1,000, the highest being 13·7 in Cuddapah and 13·0 in Kurnool.

The number of deaths registered under dysentery and diarrhœa in the Presidency was 31,307 or 0·93 per 1,000, against 29,654 or 0·89 in 1898. Of the districts, Madras as usual came first with a death-rate from this cause of 7·9, against 7·5 in the previous year, followed by Chingleput with 3·0, and Bellary with 1·9; three other districts had rates over 1 per 1,000. Of the towns, Gudiyattam recorded the high death-rate of 8·6 per 1,000, followed by Vizianagram, 8·4, Madras, 7·9, Walajapet, 7·7, Vizagapatam, 7·6, Tuticorin, 7·4, and Chingleput, 7·1, in all of which "either the conservancy arrangements are defective or the water supply is open to contamination."

Plague was imported into the Presidency towards the close of the previous year, and eleven districts were more or less affected. Precautionary measures were promptly taken, and the spread of the disease was, as a rule, successfully prevented. By the end of the year 711 attacks with 557 deaths had been reported. In 1899 the attacks rose to 2,385 and the deaths to 1,843.

Bombay.

In the Bombay Presidency, including Sind, 685,348 births were registered during the year, giving a birth-rate of 36·42 per 1,000 of population, as compared with 582,371 or 30·94 in 1898. Of the 24 collectorates and districts all but four recorded higher rates than in the previous year. Bombay City, as usual, recorded the lowest rate, viz., 12·88, against 13·08 in the previous year, and Khandesh the highest, 52·85. In ten other districts the Presidency rate was exceeded.

The total number of deaths registered in the Presidency rose from 548,825 in 1898 to 672,269, and the rate per 1,000 of population from 29·16 to 35·72, which was made up of district ratios ranging from 69·54 in Bombay City to 13·87 in Hyderabad. The increase of 123,444 deaths was spread over all the districts except three. Poona district recorded the second highest death-rate (49·67), followed by Nasik with 49·62. Three other districts, viz., Broach, Belgaum, and Dharwar, had a death-rate above 40 per 1,000, and in 11 other districts 30 per 1,000 was exceeded. In several districts the high death-rates were due to plague.

From cholera the deaths during the year rose from 4,368 or 0·23 per 1,000 in 1898 to 8,579 or 0·46. All but 376 deaths occurred in the three districts of Belgaum (4,474), Karachi (2,394), and Dharwar (1335), their respective death-rates from this cause being 4·42, 4·27, and 1·27 per 1,000 of population respectively. The disease in its epidemic form was practically confined to these three districts. Twelve of the 24 districts were entirely free from the disease during the year, and in six other districts the deaths in each were below 10. Deaths from cholera occurred in every month of the year, the months of greatest prevalence being March, April and May, when 5,747 deaths occurred. Out of 220 rural circles only 26 were affected by cholera, and 12 out of 56 town circles.

Small-pox deaths were higher by 112, the number having risen from 1,834 in 1898 to 1,946, the death-rate (0·10) remaining the same. "These figures," the Sanitary Commissioner (Lieut.-Colonel Clarkson) observes, "may be considered very satisfactory, and they testify to the exceedingly good vaccination work which now for some years has been done in the Presidency." Six of the districts were free from the disease, and in no case did the death-rate reach 1 per 1,000, the highest rate recorded being 0·56 in Thana, the result of 456 deaths, Bombay City following with 439 deaths or 0·54 per 1,000. According to age, 28·37 per cent. of the small-pox deaths occurred among infants under one year of age, and 45·73 per cent. among children between the ages of 1 and 10.

The deaths registered in the Bombay Presidency as due to fevers were more numerous by 12,114, the number having risen from 216,324 or 11·49 per 1,000 of population in 1898 to 228,438 or 12·14. These numbers do not include deaths from plague, from which there were 86,191 in 1898 and 96,596 in 1899. The average fever death-rate was exceeded in 14 districts, among the highest being 24·57 in Broach, 22·41 in Thar and Parkar, 21·75 in Ahmedabad, and 21·44 in Panch Mahals. The fever death-rate was higher than in the previous year in 13 out of the total 24 districts.

The number of deaths ascribed to dysentery and diarrhœa also rose from 56,789 or 3·02 per 1,000 of population in 1898 to 74,736 or 3·97, a ratio which is considerably higher than in any of the 12 years preceding except 1897. In nine of the 24 districts the average death-rate under this head was exceeded, the highest being again recorded by Sholapur 9·60, followed by Khandesh 9·43, Poona 7·59, Nasik 7·44, Satara 5·95, and Bombay 5·28.

From plague 96,596 deaths were reported during the year, giving a ratio of 5·13 per 1,000 of population, against 86,191 or 4·6 in 1898. The outbreak commenced in September of 1896, at the end of which 2,086 deaths had been reported, being equal to a ratio of 0·12 per 1,000. Up to the end of 1896 ten of the 24 districts had remained free of the disease, but in spite of precautions to check its progress, plague extended to all but two (Kanara and Panch Mahals) of the districts by the close of 1897, though some were but slightly affected. In 1898 all the districts were affected but three in Sind. Of the 96,596 deaths in 1899, Bombay City contributed 15,874, a decrease of 2,256 on the number reported in 1898, and the death-rate fell from 22·49 to 19·69. Poona district followed with a rate of 17·94, Belgaum 12·63, and Nasik 10·03. Only one district, Thar and Parkar, remained uninfected throughout the year. An interesting account of the further progress of the plague, and of the measures taken to suppress it, will be found in the Abstract of the Report of the Sanitary Commissioner with the Government of India, at pages 91–117.

Berar.

The total number of births registered in Berar in the course of the year was 144,034 or 50·5 per 1,000 of the population, against 89,414 or 31·3 in the previous year, which was the lowest birth-rate on record. The increase was attributed chiefly to the improved vitality of the people in consequence of the bumper harvest of 1898, and a fall in the price of food grains. In all the six districts of the province the birth-rates were higher than in the previous year, and ranged from 54·3 in Akola to 45·8 in Basim. The births exceeded the deaths in all districts, the excess being greatest in Buldana, viz., 15·6 per 1,000.

The deaths rose from 66,806 or 23·4 per 1,000 of population in 1898 to 113,992 or 39·9. All districts contributed to the increase, the excess being most marked in Akola, where the rate (50·8) was more than double that of 1898 (25·1). The provincial death-rate was exceeded in the districts of Akola (50·8) and Ellichpur (45·6). There was an increase under all the registered heads of mortality, except small-pox, the largest increase (6·8) being under all other causes and fevers (6·0).

The province was entirely free from cholera in the previous year, and remained so until August, 1899, when the disease broke out in Amraoti district. The disease prevailed during each of the five months ending December but claimed only 541 victims, giving a death-rate of 0·2 per 1,000 of population. With the exception of 1898 the mortality was the lowest recorded since 1888, in which year there were only 305 deaths from cholera.

Small-pox was not so widespread or so intense as in 1898, and caused only 305 deaths as compared with 592 in 1898, the death-rate being 0·1 per 1,000 against 0·2. Nearly a half of the deaths (142) occurred in Wun district, and the fewest number (6) in Amraoti district. About 71 per cent. of the deaths occurred amongst children under 10 years of age, 71 or 31 per cent. being infants under one year.

Under fevers the mortality rose from 32,789 or 11·5 per 1,000 in 1898 to 49,938 or 17·5. The increase was general in all districts, the death-rate varying between 22·9 in Akola and 12·9 in Buldana. The Sanitary Commissioner (Dr. Swaine) observes that influenza "which was very prevalent in 1899 as compared with 1898, especially at the end of the cold and the commencement of the hot weather, served to increase the mortality under this head."

The number of deaths attributed to dysentery and diarrhœa rose from 9,942 or 3·5 per 1,000 in the previous year to 20,263 or 7·1. Akola district recorded the highest mortality under this head, viz., 11·4, against 4·4 in the previous year, Ellichpur following with 10·6, which was also higher than the ratio (5·0) of the preceeding year. The other district rates ranged from 7·1 in Amraoti to 2·4 in Wun. "The deficient and impure water-supply" Dr. Swaine remarks "would account generally for the increase in this disease."

Two cases of plague were reported in the province during the year. One was imported from Ahmednagar district in Bombay Presidency, and terminated fatally, the other, a suspicious case, also proved fatal.

IV.—JAILS.

Sickness and mortality in 1899.

In spite of the scarcity which began to make itself felt before the close of the year under notice, and which resulted in increased admissions to jails, the general health of the prisoners was very satisfactory in 1899. "The death-rate of a comparatively small floating population" the Director-General, Indian Medical Service, remarks, "such as that of our jails is so markedly affected by the exceptional influences which occasionally operate to the detriment of the health and life of the population at large (*e.g.* epidemics and famine) that the survey of the figures of a few years is of little value. If, however, we extend our observations to the records of the last 20 years, we find that there has been a fairly consistent advance in the control of the causes of sickness and mortality in nearly every provincial group of jails."

The daily average sick per 1,000 of average strength fell from 37·3 in 1898 to 31·4, the ratio of admissions into hospital from 917 to 792, and the death-rate from 25·34 to 21·86. In every province except Bengal, Bombay, Assam and Coorg, the jail death-rate was lower than in 1898, and in four provinces the rates were lower than in any of the previous five years. In Madras the rate was the lowest on record, in Bengal the rate was only 0·9 higher than the lowest recorded, and in the North Western Provinces and Oudh it was also with the exception of 1893 the lowest on record. There was again very little cholera among the prisoners, and the convicts in the Punjab, Berar, and Coorg jails were entirely free from the disease.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1899, as compared with the previous year :—

Provinces.	1899.			1898.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,034	34	23·4	1,037	34	22·5
North-Western Provinces and Oudh.	792	38	22·2	921	47	28·7
Punjab	1,107	33	18·8	1,373	37	23·5
Burma	584	27	18·7	620	32	20·6
Central Provinces	863	27	24·4	1,134	51	34·6
Assam	982	73	48·0	1,185	54	36·6
Coorg	815	29	126·7	874	23	92·0
Madras	411	22	16·9	578	27	26·2
Bombay	599	25	25·2	756	27	21·3
Berar	445	13	13·8	581	16	14·9
India	792	31	21·9	917	37	25·3

Bengal.

The health statistics of the Bengal jails for 1899 are again exceedingly satisfactory. The admissions into hospital were in the ratio of 1,034 per 1,000 of average strength, against 1,037 in 1898, the average daily sick-rate (34 per 1,000) was practically the same, while the death-rate rose slightly from 22·5 to 23·4. These results are the more satisfactory as many parts of the province were very unhealthy and the death-rate among the general population rose from 26·57 per 1,000 in 1898 to 31·21. Among all classes of prisoners there were 448 deaths, and of these 402 were convicts. The diseases which contributed chiefly to the convict death-rate (23·0 per 1,000) were dysentery 103 deaths, respiratory diseases 99, pneumonia 50, and malarial fever 36. As in the previous year there were only three deaths from cholera. Of the 392 convicts who died in central and district jails (including four who died out of hospital), 28·57 per cent. were received in good health, 32·91 per cent. in indifferent health, and 38·52 in bad health. Out of 48 jails the average death-rate among convicts was exceeded in 22, the highest

being Barisal 62·0, Purnea 61·1, Faridpur 56·4, Suri 55·2, and Hooghly 54·9, and in three others the mortality rate was over 40 per 1,000. In four jails there were no deaths, and in five there was only one death in each.

North-Western Provinces and Oudh.

The sanitary history of the jails of the North-Western Provinces for 1899 is again satisfactory. There was a further improvement as regards the sickness and mortality, the admissions into hospital, which was the lowest recorded with the exception of that for the year 1893, having fallen from 921 per 1,000 of average strength in 1898 to 792, the daily average sick-rate from 47 to 38 per 1,000, and the death-rate from 28·7 to 22·2. Of the 55 jails in the province there were no deaths in one, and 19 others recorded death-rates below the provincial jail rate. The highest mortality (89·0) occurred, as usual, in Mirzapur district jail, followed by Banda 48·5, Ghazipur 46·0, besides Lalitpur and Pauri jails, in which the average was very small, and "the proportion of deaths is therefore not a sure criterion." The conditions of the Mirzapur jail have often been brought to notice and remedial measures undertaken ; but the Inspector-General does not believe that its unhealthiness depends on removable defects in the sanitation of the jail itself. He says that the site of the jail is bad and its surroundings hopelessly insanitary, and he suggests that a new jail should be built in a more healthy locality. Chief among the jails with a low mortality was Bareilly Central Prison, with only 8·8 per 1,000 on an average strength of 2,012 convicts. Only one fatal case of cholera was reported during the year. Of other diseases, dysentery was accountable for 144 deaths against 190 in 1898. From pneumonia there were 121 deaths against 135 ; other respiratory diseases were also less fatal than in the preceding year. Of the total 652 deaths 600 were of convicts, their death-rate being 21·8 per 1,000 against 28·8 in the previous year.

Punjab.

The health of the prison population of the Punjab greatly improved during 1899. The admissions to hospital per 1,000 of average strength fell from 1,373 in 1898 to 1,107, the daily sick-rate from 37 to 33, and the death-rate from 23·5 to 18·8. Only in three years since 1880 has the mortality been lower, which is the more satisfactory considering the unfavourable climatic conditions that prevailed in the province during 1897 and 1898. "The figures," the Inspector General states, "besides bearing testimony to the excellence of the medical work done will, I hope, encourage all officers immediately responsible for the welfare of the prisoners in our jails to persevere in their efforts to still further reduce preventable mortality. . . . I am persuaded that reasonable attention given to details affecting health, far from weakening discipline is calculated to strengthen it." The provincial death-rate was exceeded in 10 jails, the highest being 38·02 in Mooltan Central jail, 35·39 in Lahore Central jail, and 34·97 in Bannu district jail. In six jails there were no deaths. Of the total 251 deaths, all but 20 were of convicts, giving a death-rate of 19·12. A satisfactory feature of the year was the decline in the prevalence of dysentery, the deaths from which fell from 49 to 31. The most fatal disease was pneumonia, which contributed 63 deaths or 5 less than in 1898. The jails were again free from cholera during the year. More than half the deaths occurred from diseases of the lungs in one form or another.

Burma.

The Burma jail statistics for 1899 are much more satisfactory than those for the previous year, and show that the health of the prisoners had improved considerably. The admissions to hospital per 1,000 of average strength fell from 620 to 584, the daily sick-rate from 32 to 27, and the death-rate from 20·6 to 18·7. Of the 235 deaths which occurred during the year, all but 10 were of convicts, the death-rate being 18·44 against 20·39 in 1898. There were 42 cases of cholera with 24 deaths, which were spread over eight jails ; but the largest and only important outbreak occurred in Moulmein jail, which returned 19 cases and 11 deaths. In the previous year there were only three deaths from cholera. Eleven of the 31 jails recorded death-rates exceeding the provincial average, but in several cases the average strength was small. In eight jails there were no deaths among convicts. Moulmein retains its reputation for unhealthiness. Of the 40 deaths in this jail, 15 were from dysentery and 11 from cholera. The status of this jail has been lowered from that of a Central to that of a District jail.

Central Provinces.

The vital statistics of the jails of the Central Provinces for 1899 are very satisfactory, which however is not surprising, as the year is reported to have been an unusually healthy one. The ratios of admissions into hospital, of daily sick and of deaths, which in 1898 were 1,134, 51 and 34·6 per 1,000 of average strength, fell to 863, 27 and 24·4 respectively in

1899. Deaths diminished in the aggregate by nearly one half the number of the previous year, and Narsinghpur was the only jail out of the 19 in the province at which there was an increase in mortality. The average death-rate was made up of jail-rates varying from 60·0 in Narsinghpur to 7·0 in Hoshangabad. In five jails there were no deaths. All the jails were free from cholera except Bilaspur, where there was one death from it. Under all other causes the admissions were less than in 1898, and this was also the case with the deaths except under malarial fevers, where the deaths rose from 4 to 8, and under pneumonia, where the number of deaths was identical in both years. All but 10 of the 93 deaths occurred amongst convicts, the death-rate being 24·4, against 35·18 in 1899.

Among the prison population of Assam the rate of admissions to hospital fell from 1,185 per 1,000 in 1898 to 982 in 1899, the daily sick-rate rose from 54 to 73, and the death-rate from 36·6 to 48·0. The increase in the death-rate was chiefly due to a very severe outbreak of cholera in the Gauhati jail in October, which accounted for 18 deaths. Excluding cholera, the mortality was practically the same as in the previous year. In discussing the high mortality in the Assam jails, the Chief Commissioner suggests that it may be due to exposure involved in extramural labour, a point which he states must be thoroughly tested for at least two or three years. In only three of the 24 jails was the average strength above 100, viz., Sylhet, Tezpur, and Gauhati, and these three accounted for 70 out of the total 78 deaths. In the other jails the average strength varied from 8 to 62. In three jails there were no deaths. All but four of the 78 deaths occurred amongst convicts, being in the ratio of 49·73 per 1,000 against 35·43 in 1898. There were 26 cases of cholera with 18 deaths, all of which occurred in Gauhati jail; in the previous year there was only one death from this disease. From dysentery and diarrhœa there were 14 deaths, and from malarial fevers 15. Assam.

In the jails of Madras Presidency the general health of the prisoners during 1899 was very satisfactory. The hospital admission rate fell from 578 per 1,000 of average strength in 1898 to 411, the daily sick-rate from 27 to 22 per 1,000, and the death-rate from 26·2 to 16·9. The sick-rate was the lowest since 1891, and the rate of mortality was the lowest on record. These results are mainly attributable to the comparative immunity from serious epidemics and to the general healthiness of the Presidency, and to the care bestowed on sick prisoners by medical officers. As in 1898, there was a remarkable absence of epidemic cholera, only two deaths having been recorded from the disease; there was also a considerable reduction in the number of cases of dysentery, and the rate of mortality fell from 6·04 to 1·34. Pneumonia and other respiratory diseases were also less fatal. Of the larger or central jails, Trichinopoly was the only one in which the normal death-rate was exceeded, that for 1899 being 31·26 against 31·06 in the previous year. In 1898, the high mortality in the Rajahmandry Central Prison (193·14) called for detailed notice, but it is satisfactory to observe that there was a remarkable improvement in the health of the prisoners in the year under notice, the death-rate having fallen to 14·28. In none of the other jails, with a strength of over 200, did the mortality reach 30 per 1,000; while in five jails there were no deaths. Of the total 182 deaths convicts contributed 147, representing a ratio of 16·70 per 1,000 of average strength, as compared with 28·09 in 1898. Madras.

Although nearly all the jails in the Bombay Presidency were again overcrowded during 1899, the health of the prisoners was fairly good. The rate of admissions to hospitals per 1,000 of average strength fell from 756 to 599, the daily sick-rate (25) was 2 per 1,000 less, and the death-rate rose from 21·3 to 25·2 per 1,000. The death-rate was under 20 per 1,000 of average strength in ten jails, in three it ranged between 20 and 30; while those with rates over 30 were the Common Prison 120, Thana 71·6, and Dharwar 45·2. All but 39 of the total 276 deaths (including 27 in the lock-ups) occurred among the convicts, their death-rate being 25·9 against 22·5 in 1898. The chief causes of mortality were dysentery and diarrhœa 38 deaths, respiratory diseases 48, including 36 from pneumonia, fevers 13, and tubercle of the lungs, &c., 23. There were only seven cholera deaths, all of which occurred among the convicts in Dharwar jail out of a total mortality of 22. In spite of the prevalence of plague in the Presidency only 15 cases occurred among the prisoners, of which eight proved fatal, against 39 cases and 22 deaths in the previous year. The measures taken for preventing the dissemination of the disease were good and effectual, especially in Dharwar prison, plague having been very rife in the town and district for some months in the year. Bombay.

Berar.

The health of the jail population of Berar in 1899 was exceptionally good. The rate of admissions into hospital per 1,000 of average strength fell from 581 to 445, the daily sick-rate from 16 to 13, and the death-rate from 14·9 to 13·8. The fall in the death-rate is the more remarkable as among the general population the mortality rose from 23·4 per 1,000 to 39·9. There was no outbreak of epidemic disease in any of the jails, and cholera was absent. There were only 19 deaths, including one at Secunderabad, against 24 in 1898. All but one of the 18 deaths occurred in the larger jails at Akola and Amraoti, eight in the former and nine in the latter. There were no deaths in three jails. All but three of the 19 deaths occurred amongst convicts, their death-rate being 13·52 per 1,000, as compared with 15·28 in 1898.

V.—VACCINATION.

During 1899-1900 there were 7,437,916 persons successfully vaccinated in the several provinces of India, being an increase of 577,001 on the number of the previous year. After the falling off in the two preceding years, owing mainly to plague and famine, this increase must be considered satisfactory, and especially so as it was contributed to in varying degrees by all the provinces. According to age, nearly 3½ millions (3,449,012) of the total were children under one year of age, and nearly 3 millions (2,982,724) were children between the ages of one and six years. The proportion of population protected against small-pox by the year's operations ranged from 56·72 in Burma to 28·72 in Madras. In the vaccination of infants the best results were, as usual, obtained in Berar and the Punjab, followed by the Central Provinces and Bombay, where 83·00, 66·55, 60·18, and 56·30 per cent. respectively of the children born during the year (estimated at 40 per 1,000 of population) were protected against small-pox. In the North-Western Provinces and Oudh the percentage was 45·24, and in the remaining provinces it ranged from 40·14 in Burma to 11·70 in Coorg. General results.

Statement showing the total number of persons successfully vaccinated during the year 1899–1900 :—

Province.	Population among whom Vaccination was carried on (Census of 1891).	Number of Persons successfully vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Children born during the Year (calculated at 40 per 1,000 of Population) successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	70,974,023	2,176,895	30·67	619,068	1,353,939	21·81
North-Western Provinces and Oudh.	47,146,033	1,414,082	29·99	853,065	438,741	45·24
Punjab	20,553,982	820,506	39·92	547,113	127,657	66·55
Burma	8,146,855	462,102	56·72	130,822	210,525	40·14
Central Provinces	12,739,620	483,141	37·92	306,669	96,440	60·18
Assam	5,716,833	255,562	46·62	61,793	121,415	27·02
Madras Presidency	35,651,577	1,023,980	28·72	324,241	506,545	22·74
Bombay Presidency	22,612,220	666,871	29·49	509,251	108,851	56·30
Berar	2,897,040	125,311	43·2	96,180	14,285	83·00
Coorg	173,055	9,466	54·70	810	4,326	11·70
TOTAL	226,611,238	7,437,916	32·86	3,449,012	2,982,724	38·05

The total number of vaccinations performed in Bengal during 1899–1900 was 2,252,521 of which 2,176,895 were successful, against corresponding figures in 1898–99 of 2,147,452 and 2,085,904. This shows an increase of 105,069 vaccinations in 1899–1900, which, however, was confined to few districts, as there was a decrease in 21 districts, due in most cases to the prevalence of cholera, malarial fever, and plague, and to the general unhealthiness of the year. In some districts the work was retarded by the alarm occasioned by plague. The primary operations numbered 2,203,084, of which 97·67 per cent. were successful. According to age, 619,068 of the successful primary vaccinations were of children under one year of age, and 1,353,939 were between one and six years. For the whole province the successful vaccinations were in the proportion of 30·67 per 1,000 of the population. Estimating the births during the year at 40 per 1,000, the percentage of infants successfully vaccinated was 21·81, which is a little less than that for Madras, and far below that attained in other provinces except Coorg. Bengal.

Three methods of vaccination are practised in the province—(1) with lymph taken direct from the calf; (2) with calf lymph prepared with lanoline; (3) with human lymph taken by arm to arm transfer. Compared with the previous year's figures there was an increase of 35,000 in the number of primary operations performed direct from the calf.

North-Western Provinces and Oudh.

In spite of the fact that many experienced and senior vaccinators were again in several districts employed on plague duty and were replaced by new and inexperienced men, the number of persons vaccinated in the North-Western Provinces of Oudh during 1899–1900 rose from 1,398,684 in the previous year to 1,511,436. The increase was spread over 41 districts and ranged from 9,261 in Gorakphur to 182 in Etawah. The proportion of persons protected by vaccination is still very small, the ratio for the year being only 29·99 per 1,000. Primary vaccinations numbered 1,449,653, of which 97·00 per cent. were successful. Of the 1,365,931 successful primary cases, 853,065 were infants and 438,741 were children over one and under six years of age. Estimating the birth-rate at 40 per 1,000 of the population, 45·24 per cent. were successfully vaccinated during the year.

The provinces are divided into two circles for the purposes of control, each being in charge of a Commissioned Medical Officer, acting as Superintendent of Vaccination and Deputy Sanitary Commissioner. In the first or western circle, the average ratio of successful vaccinations was 31·58 per 1,000 of the population. In the second or eastern circle, the average ratio was 28·59. The Vaccination Act is in force in all the municipalities, but the thoroughness of enforcement still varies considerably. There was however an increase of 14,828 in successful primary vaccinations in these towns, and the proportion of persons successfully vaccinated per 1,000 of population rose from 33·10 per 1,000 in 1898 to 37·97.

Punjab.

There was a satisfactory increase in the number of vaccinations in the Punjab, as compared with the preceding year. Altogether 943,074 operations were performed in 1899–1900, showing an increase of 102,206 on the figures of 1898–99. The success achieved is attributed to the work being done in a more systematic way, the vaccinators having worked in bodies instead of as isolated units as in the previous year. The primary vaccinations numbered 744,917 with a percentage of success of 94·68. The most notable increase was in the Hissar district (31,959) which was due to the people being collected in famine camps. Only in eight districts out of 31 was there a decrease. Kangra is the best vaccinated district in the province and was practically free from small-pox during the year. On the other hand Peshawar, the least vaccinated district, had a severe attack, 2,288 deaths having been registered from the disease. In this district the people are reported to be averse to vaccination and inoculation is common. The number of successful cases among children under one year of age rose from 493,085 or 59·9 per cent. of the births, calculated at 40 per 1,000 of population, to 547,113 or 66·5 per cent. The provincial ratio of persons successfully vaccinated per 1,000 of the total population was 39·92, against 35·41 in the previous year. At the end of the year the Vaccination Act was in force in 22 towns and 11 cantonments.

Burma.

With a small increase in the number of vaccinators employed in the province of Burma an almost proportionate increase in the number of persons vaccinated resulted. The total number of persons vaccinated was 503,514, as compared with 480,657 in the previous year. Out of 463,605 primary cases, 94·8 per cent. were successful, a ratio identically the same as in the previous year. The number of infants protected was 130,822, equal to 40·14 per cent. of the births, estimated at 40 per 1,000 of the population. The returns for the Rangoon municipality were again very unsatisfactory. The number of primary vaccinations, fell from 5,516 to 2,457 and re-vaccinations from 4,938 to 2,899 ; while only 1,119 children under one year of age were successively vaccinated out of a total of 3,164 births. The Act for the compulsory vaccination of children is in force in all the municipalities of the province and with a view to further provide for compulsory vaccination in the province the Burma Vaccination Law Amendment Act was passed during the year. This Act empowers Superintendents of Vaccination in Rangoon Municipality, and in other municipalities to which the Act may be extended, to require unprotected persons to be vaccinated, and provides also for the compulsory vaccination of inmates of lodging houses or coolie barracks. These powers, the Sanitary Commissioner with the Government of India observes, "should avail for the protection of the coolie immigrants in Rangoon, a class very liable to harbour and spread small-pox, the compulsory vaccination of whom was discontinued in August, 1896."

Central Provinces.

On the whole good progress was made in vaccination work in the Central Provinces in 1899–1900. All but two of the 18 districts shared in the increase and "the figures" the Sanitary Commissioner remarks, "go to show that irrespective of the widespread scarcity and distress which prevailed among the general population during the last season, and the fact that a portion of the vaccination establishment was employed on famine, cholera, and

plague duty for a considerable period during the season, excellent work has been done by vaccinators." There were 509,323 persons vaccinated during the year, showing an increase of 60,073 on the number of the previous year. Primary vaccinations rose from 383,633 to 456,857 and the percentage of success from 96·33 to 96·82. The ratio of successful vaccinations in the year to the total population was 37·92 per 1,000, as compared with 31·70 in 1898–99. In the protection of infants there was an increase of 76,449, the number vaccinated under one year of age during the year having risen from 230,220 to 306,669, being equal to 60·18 per cent. of the births estimated at 40 per 1,000 of population. Animal lymph was used in the bulk of the vaccinations, and worked very successfully, and there is now little prejudice against its use in the province. Arm-to-arm vaccination is practised in very few places. With the lymph obtained from calves, 276,137 children were vaccinated during the year, and of these 264,099 were successful. The use of glycerinated lymph was attended with more satisfactory results than in the previous year, the percentage of success attained being 86·27 against 72·69.

Assam.

During the year 1899–1900 272,265 vaccinations were performed by all agencies in the province of Assam, being an increase of 13,360 on the previous year's work. The increase was not shared by all districts, five having recorded a decrease, chief among them being Kamrup. The increase was greatest in Sylhet, where the number rose from 72,292 to 84,359. Of the total operations 255,131 were primary cases, and of these 98·50 per cent. were reported as successful; this high average was attributed to the consistently excellent quality of the Shillong lymph. The Compulsory Vaccination Act continued in force during the year in the same 11 towns as in the previous year, but the number of vaccinations again fell. The number of infants successfully vaccinated was 61,793, representing only 27·02 per cent. of the births, estimated at 40 per 1,000 of the population, and the proportion of the population successfully vaccinated in the year was 46·62 per 1,000. Arm-to-arm vaccination has been abandoned throughout the province, the practice of inoculation is said to be dying out, "and no epidemic of small-pox could be traced to a survival of this custom."

Madras.

The total number of vaccinations performed in the Madras Presidency during 1899–1900 was 1,159,409, being an increase of 41,416 on the operations of the previous year, the increase being mainly attributable to a steady subsidence of the plague inoculation scare which caused the large fall in the previous year. Of the total, 1,096,821 were primary cases, of which 91·8 per cent. were successful, against 89·5 per cent. in 1898–99. The number of children under one year of age successfully vaccinated rose from 282,969 to 324,241, which represented only 22·74 per cent. of the estimated births. Vaccination is compulsory in all municipalities, and the number of operations performed by municipal vaccinators rose from 118,140 to 120,442. In the town of Madras the number of operations performed was 24,959, a decrease of 3,227 on the previous year, which was chiefly due to small-pox being less prevalent. Of the 21 districts, seven recorded a decrease of work, the most marked cases being those of Vizagapatam (16,738), Ganjam (5,065), Trichinopoly (4,838), and Coimbatore (4,629). The decrease in Vizagapatam is to be regretted, as the largest increase occurred in this district in the previous year. Among the districts showing the largest increase, Godavari came first with 17,819, followed by North Arcot 11,302, Tanjore 7,724, Salem 7,500, Tinnevelli 7,290, and Kistna 7,088. All the operations except one were performed solely with animal lymph, and the best results were obtained, as usual, from calf-to-arm vaccination, with a percentage of success of 97·3.

Bombay.

There was a considerable increase in the number vaccinated in the Bombay Presidency in 1899–1900 as compared with the previous year, though the figures were still below those recorded during each of the three years preceding 1898–99. Omitting the statistics of five Native States which are not under the supervision of the Vaccination Department, the out-turn of vaccination work in the Presidency rose from 669,652 operations in 1898–99 to 768,671. The total primary cases rose from 621,310 to 679,467, the percentages of success being respectively 92·84 and 92·60. The substitution of animal for human lymph continued to increase in the Presidency. In the City of Bombay vaccination with animal lymph has been in use for many years past. Of the 629,744 primary successful cases, nearly 81 per cent. were infants under one year of age. Reckoning the births at 40 per 1,000 of population, 56·30 per cent. were protected from small-pox. Inoculation was not practised anywhere in the Presidency during the year, and no instances were reported of any disease having been communicated through vaccination. The protection afforded to the population by the year's operations was in the ratio of 29·49 per 1,000.

Berar.

Considerable progress was made in vaccination work in Berar during 1899–1900, the number of persons vaccinated having risen from 132,903 in the previous year to 175,901, which is the highest number ever recorded in the province. The primary vaccinations rose from 94,032 to 120,772 ; but the percentage of success fell from 97·1 to 95·8. Of the total number of successful primary operations, 96,180 were performed on infants under one year of age ; estimating the births at 40 per 1,000 of population, 83·0 per cent. were protected against small-pox, and the proportion of population protected by vaccination rose from 34·6 in the previous year to 43·2. The increase in primary vaccinations was spread over all the districts. The large increase in primary work was due to the increased birth-rate, which reached 50 per 1,000 ; to the famine, bringing an influx of unvaccinated from across the Moglai border ; and to the vaccinators being able to get at children on famine relief works more readily. The Sanitary Commissioner continues his statement showing the efficacy of vaccination in checking small-pox mortality in Berar ; the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of five years 1868–69 to 1872–73, to 33·6, the mean of five years ending 1897–98 ; the mortality from small-pox for the same periods has declined from 2·02 to 0·19 per 1,000. In 1898–99 and 1899–1900 the ratios of successful vaccinations per 1,000 of population were 34·6 and 43·2, and the death-rate from small-pox 0·2 and 0·1 per 1,000. The Vaccination Act is now in force in all the municipal towns.

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VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1899 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1898	487	42,086	2,837,759	2,879,845
	1899	513	47,897	3,243,346	3,291,243
Calcutta and Howrah	1898	15	23,732	187,518	211,250
	1899	15	24,146	219,302	243,448
North-Western Provinces and Oudh	1898	369	55,589	3,801,255	3,856,844
	1899	374	59,643	3,939,022	3,998,665
Punjab	1898	267	49,068	2,976,321	3,025,389
	1899	272	51,967	3,102,310	3,154,277
Burma	1898	105	34,091	765,430	799,521
	1899	110	34,749	783,290	818,039
Central Provinces	1898	125	11,179	1,536,739	1,547,918
	1899	127	11,434	1,520,208	1,531,642
Assam	1898	108	6,977	603,290	610,267
	1899	115	6,217	617,586	623,803
Coorg	1898	7	1,381	40,015	41,396
	1899	7	1,040	32,713	33,753
Madras	1898	486	60,244	4,209,331	4,269,575
	1899	537	63,184	4,375,053	4,438,237
Bombay	1898	325	46,468	1,787,787	1,834,255
	1899	354	50,902	2,078,979	2,129,881
Berar	1898	48	4,068	321,311	325,379
	1899	48	4,590	327,108	331,698
TOTAL	1898	2,342	334,883	19,066,756	19,401,639
	1899	2,472	355,769	20,238,917	20,594,686

The total number of dispensaries at work during 1899 in Bengal, exclusive of the medical institutions at Calcutta, was 513, an increase of 26 on the number of the preceding year. At these there were 3,291,243 patients under treatment, 47,897 being in-door and 3,243,346 out-door patients, against 42,086 and 2,837,759 respectively in the previous year. This shows a total increase of 411,398. "In view of the fact," the Local Government observe, "that the general mortality figure of the year 1899, though higher than that recorded in 1898, was considerably lower than in any of the four preceding years, this increase can only be attributed to the growing popularity of dispensaries." The attendance of in-patients has not yet returned to the position it held previous to the plague scare, but the number of out-patients is by far the largest ever recorded. Bengal.

There was again a satisfactory increase in the number both of women and children patients. The increase among women amounted to 55,446, the number having risen from 462,412 to 517,858. The proportion of women to men was, however, about the same as in the previous year, viz., 17·84 against 17·81 per cent. Of the diseases under treatment at the

dispensaries, malarial fevers, skin diseases, and dysentery and diarrhœa were responsible, as usual, for the largest number of cases. From malarial fever there were 623,173 cases, equal to nearly 19 per cent. of the total number of patients, against 527,695 in 1898 ; from skin diseases the number of cases rose from 402,890 to 501,830 ; from dysentery and diarrhœa there were 168,060 cases, against 154,117 in 1898, and "the fact that this increase is nearly four times that of the general mortality under these heads is a special testimony to the growing popularity of the dispensaries." From cholera the number of patients rose from 6,425 to 10,638. Cases of venereal diseases rose from 77,603 to 81,602. The number of deaths among in-door patients rose from 4,718 or 112·0 per 1,000 of total treated in 1898 to 5,559 or 116·0 in 1899. Great attention is paid in these institutions to surgery, and during the year 145,379 operations were performed, against 137,123 in 1898, and of these 230 terminated fatally. Among the more important operations there were 2,682 cases of extraction of the lens.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1899 and the previous year :—

Name of Institution.	1899.				1898.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	4,482	34,338	38,820	156·0	4,667	28,386	33,053	109·2
Eden Hospital	1,547	2,125	3,672	75·6	1,413	3,423	14,836	77·1
Ezra Hospital..	230	—	230	30·4	244	—	244	24·5
Shama Churn Law Eye Hospital	476	13,103	13,579	2·1	505	11,058	11,563	—
Presidency General Hospital	2,993	1,118	4,111	44·4	2,468	717	3,185	44·9
Campbell Hospital	6,823	20,288	27,111	256·0	7,524	17,826	25,350	229·7
Police Hospital	2,986	—	2,996	6·9	3,011	—	3,011	8·6
Mayo Native Hospital	1,710	23,674	25,384	130·6	1,437	19,673	21,110	96·7
Chandney Hospital	276	38,706	38,982	119·5	246	33,050	33,296	81·3
Park Street Dispensary	—	24,529	24,529	—	—	21,808	21,806	—
Chitpore Dispensary	—	15,939	15,939	—	—	13,826	13,826	—
Sukea's Street Dispensary	—	13,492	13,492	—	—	11,363	11,363	—
Dufferin Victoria Hospital	164	4,077	4,241	12·1	149	4,562	4,711	6·7
Sambu Nath Pandit Hospital	831	15,783	16,614	173·2	606	11,186	11,792	176·5
Total Calcutta Hospitals and Dispensaries	22,528	207,172	229,700	138·9	22,270	176,878	199,148	123·8
Howrah General Hospital	1,618	12,130	13,748	202·7	1,462	10,640	12,102	207·9
Grand Total	24,146	219,302	243,448	143·2	23,732	187,518	211,250	129·0

The figures for 1899 show an increase of 31,784 in out-door patients, and of 414 in in-door patients. The death-rate for all the hospitals was 143·2 per 1,000 of the total in-patients, against 129·0 in the previous year. Cholera patients rose from 227 to 355, and the fatal cases from 122 to 227. The increase was most marked in the Campbell Hospital, where 136 cases were treated against 89 in the previous year. Small-pox was slightly more prevalent in Calcutta than in the previous year, and the cases admitted to hospital rose from 36 to 42. Dysentery patients rose from 5,571 to 6,404. The number of patients treated for diarrhœa also rose from 6,244 to 6,673 ; malarial fever was responsible for 46,131 patients against 37,276. Plague cases treated rose from 135 to 229, and the deaths from 116 to 198. Venereal diseases show an increase of 609 patients, the number treated having risen from 10,550 in the previous year to 11,159. Surgical operations increased from 21,610 to 25,109, and death ensued in 154 cases in both years.

North-Western Provinces and Oudh.

During 1899 there were 374 hospitals and dispensaries at work in the North-Western Provinces and Oudh, or 5 more than in the previous year. The number of patients who received medical aid was 3,998,665 against 3,856,844, in 1898. There was thus an increase in 1899 of 141,821. The number of in-patients rose from 55,589 to 59,643. Of the total number, 51·6 per cent. were men, 22·9 per cent. were women, and 25·5 per cent.

were children, the last two showing a small increase on the figures of the previous year. Among the in-door patients there were 2,865 deaths, against 2,801, but the death-rate fell from 50·3 to 48·0 per 1,000. Of the diseases for which the patients were treated 661,153 were suffering from malarial fevers, a decrease of 30,826 on the number of 1898; 520 cases of cholera were treated in the dispensaries, against 368, and cases of diseases of the eye rose from 318,522 to 365,369. From venereal diseases there were 82,884 patients, against 95,165 in the previous year. The number of surgical cases rose from 175,708 to 180,190, of which 149,499 resulted in cure and 390 were fatal. Of the total operations 5,778 were for cataract, of which nearly 84 per cent. were successful, as compared with 5,648 operations and a percentage of success of 83 in 1898.

Punjab.

The number of dispensaries at work in the Punjab during 1899 was 272 or five more than in the previous year. At these, 3,154,277 patients were under treatment, being an increase of 128,888 on the number of 1898. The attendance of in-door patients was greater than in the previous year by 2,899, the number having risen from 49,068 to 51,967. This improvement is satisfactory, as there had been an annual decrease in the number of in-patients since 1894, for which year the number was 56,254; and as the same circumstances which had tended to operate against attendance in previous years existed in 1899, the increase may be attributed to the popularity of the institutions. Of the diseases for which patients sought relief there were only 219 cases of cholera, though this is a large increase on three in 1898. Cases of malarial fever fell from 463,223 to 381,465. Diseases of the eye showed an increase of 66,974 cases, the number treated in 1899 being 448,382, against 381,408. From venereal diseases there were 30,002 cases under treatment, an increase of 1,363 on the previous year's figures. Among the in-patients there were 2,292 deaths during the year, being in the ratio of 44·1 per 1,000 of the number treated, against a death-rate of 42·0 in 1898. The number of surgical operations amounted to 170,051, which, compared with the previous year, shows a falling off; but there was really an increase, as, in the year under notice, orders were issued directing that certain operations were in future to be excluded from dispensary returns. Of these no less than 13,410 were, it is stated, included in the returns for 1898, and if this number is deducted the number of operations is reduced to 157,399 or 12,652 less than in 1899. Of the 170,051 operations, 162,394 were cured and 282 died. There were 5,321 cataract operations, and of these 85·7 per cent. resulted in cure.

Burma.

The number of dispensaries existing in Burma at the end of 1899 was 110, or five more than in the previous year. At these, 818,039 patients attended, as compared with 799,521 in 1898. The number of in-door patients rose from 34,091 to 34,749, of whom 25,591 were cured, and 2,611 or 75 per 1,000 died, against 2,487 deaths or 73 per 1,000 in the previous year. Nearly 58 per cent. of the patients treated were Burmese. Malarial fevers, as usual, headed the list of maladies under treatment, the number of cases being 125,373, against 127,177 in the previous year. Cholera was more prevalent than in 1898, and the number of cases rose from 342 to 581. Cases of venereal disease fell from 28,966 in 1898 to 24,627. Surgical work showed an increase of 664 operations, the number performed during the year having risen from 16,490 to 17,154; though showing a slight improvement, the result is not considered satisfactory "in a province like Burma, where there is practically an unlimited field for the expansion of surgery." The number of patients cured, after being subject to operation, was 16,460 and 80 died.

Central Provinces.

The number of hospitals and dispensaries at work in the Central Provinces during 1899 was 127, or 2 more than in the previous year. The total number of patients fell from 1,547,918 to 1,531,642. The decrease, however, extended only to out-door patients, the in-door patients having risen from 11,179 to 11,434. The diminished out-door attendance is attributed by the Administrative Medical Officer to the large number of people who, during the last three months of the year, resorted to famine relief camps, and whose sick (40,324) were treated in the special hospitals attached thereto. Among the in-patients there were 892 deaths or 78·0 per 1,000 of total treated, against 1,042 or 93·2 in 1898. As regards the different kinds of diseases, the most remarkable feature was the further large decrease of cases of malarial fevers by 36,544. On the other hand there was an increase of 3,699 cases of dysentery and diarrhœa. From venereal diseases there was a decrease of 1,134 cases. There were 34,884 surgical operations performed, against 39,552 in 1898. Of these, 33,146 resulted in cure and 69 in death. Operations for cataract declined from 1,026 in 1898 to 953.

Assam.

In the province of Assam there were 115 dispensaries at work during the year, or seven more than in the previous year. The total number of patients treated was 623,803,

against 610,267 in 1898. The increase was entirely in out-door patients, and apparent only, " being almost wholly due to the seven new dispensaries opened during the year." The in-patients declined from 6,977 to 6,217, and of these 3,600 were discharged cured, 476 relieved, 932 discharged otherwise, and 942 died, the latter representing 151·5 per 1,000 of the total in-patients, against a ratio of 160·7 in 1898. The decline in in-door attendance is attributed to the unusual healthiness of the year, cholera being much less prevalent, as were also kala-azar and malarial fevers. Of the 942 deaths 387 were due to pauperism and starvation amongst waifs and strays from the railway and tea estates. Of the total attendance, only 14 per cent. were women. This is, however, an increase on the previous year's figures, and as arrangements have now been made at all dispensaries for women to be received in a separate apartment with a separate entrance, it is expected that their attendance will go on increasing yearly. Of the total number of persons who received medical aid, malarial fever accounted for 142,736 cases, including 3,736 suffering from kala-azar, against 5,572 from this disease in the previous year; dysentery and diarrhœa 29,970, and diseases of the digestive system 32,640. Cholera patients declined from 2,972 in 1898 to 1,449. With the exception of a rather severe local outbreak at Mullapara in Sylhet, resulting in 470 cases, most of the cholera cases occurred in the Goalpara district. Of surgical cases there were 15,066, of which 14,467 were cured and 39 were fatal.

Madras. Exclusive of the hospitals in the Presidency town there were 523 civil hospitals and dispensaries working in Madras at the close of 1899, or 51 more than in 1898, but several were closed for broken periods during the year. There were 4,226,308 patients under treatment, as compared with 4,067,111 in 1898. There was thus an increase of 159,197. Of the 46,510 in-door patients, 30,399 were returned as having been cured under treatment, 8,505 as relieved, and 3,478 as otherwise discharged. The deaths numbered 2,502, representing a ratio of 54·2 per 1,000 of the total in-patients, against 71·1 in the previous year. Ulcers and diseases of the skin, malarial fevers, diseases of the eye, diseases of the digestive system, rheumatic affections, dysentery, and worms were the most common diseases under treatment during the year. Cholera was much less prevalent in the Presidency than in the previous year, and the cases under treatment in the various hospitals and dispensaries fell from 9,783 to 3,234. From venereal diseases there were 78,002 cases, against 83,328 in 1898. The surgical operations fell from 147,001 in 1898 to 121,261. Of these, 115,401 were cured and 173 were fatal.

The number of medical institutions in Madras town remained the same as in 1898, but the number of sick treated rose from 202,464 to 211,929. The in-patients fell from 18,584 to 16,674, and amongst them 8,402 cases were recorded to have been cured or perfectly recovered, 3,254 were relieved, 3,035 discharged otherwise, and 1,098 or 65·9 per 1,000 died, against a rate of mortality in 1898 of 80·2. The decrease in mortality was chiefly under small-pox, measles, fevers, and cholera. Of the several diseases for which the patients were treated, malarial fever, diseases of the digestive system, skin, and respiratory system were, as usual, the most common. From cholera there were only 28 cases, against 505 in the previous year, from dysentery and diarrhœa 7,797, and from venereal diseases 3,804. Fewer surgical operations were performed, the number having declined from 28,725 in 1898 to 16,243. The results showed that 12,373 cases were cured, 2,646 relieved, and 114 were fatal.

At the Madras Voluntary Venereal Hospital, which is included in the above hospitals in the city, there were 512 female patients treated during 1899, a decrease of 126 on the number of the previous year.

ombay. Excluding the 11 medical institutions in the City of Bombay, there were 343 hospitals and dispensaries working in the Presidency at the end of 1899. At these, 2,029,422 patients were under treatment, of whom 32,831 were in-door and 1,996,591 out-door patients, against 29,904 and 1,721,332 respectively in 1898. The attendance of patients was rapidly returning to the normal; for whereas the total treated in the year 1897 was 639,265 less than that of 1895, the figures for the year under report are only 352,647 short of those of the year 1895, which preceded the appearance of plague. Malarial fevers, as usual, constituted by far the largest number of cases (347,747), and showed an increase of 45,642 on the figures of the previous year. Next to fever, eye and skin diseases and worms were the most common ailments. The only important disease which showed a decrease was small-pox, the number of cases having fallen from 438 in 1898 to 194; cholera cases rose from 606 to 630; dysentery cases were also more numerous; and patients suffering from venereal affections rose from 27,217 in 1898 to 32,801 in 1899.

Of the in-door patients 23,300 were cured, 2,258 relieved, 1,894 discharged otherwise, and 3,810 died, the ratio of deaths to total treated being 116 per 1,000, against 103 in the preceding year. The total number of patients operated on was 72,518, as compared with 83,255 in 1898, and of these 62,243 were cured and 213 died. The large decrease in the number of operations is owing to the omission of certain comparatively trivial procedures as desired by the Government of India; but on the whole the more important operations slightly exceeded the number of the previous year.

The total number of patients treated at the 11 civil medical institutions working in the town of Bombay during 1899 showed an increase of 17,440, the figures being 100,459, against 83,019, in the previous year. The in-patients increased in number from 16,564 to 18,071, and of these 10,801 were cured, 3,016 relieved, 926 otherwise discharged, and 2,335 died, the deaths being in the ratio of 129 per 1,000 of the in-patients, against 125 per 1,000 in 1898. As usual, local injuries, malarial fevers, eye diseases, and skin diseases were responsible for the majority of the cases. Venereal diseases contributed 3,626 cases, against 3,771. There were no cases of cholera under treatment; but dysentery cases rose from 1,040 to 1,449, and diarrhœa cases from 2,830 to 3,805. The total number of patients operated on was 10,401, and of these 6,519 were cured, 185 relieved, 67 discharged otherwise, and 192 died.

Berar.

There were 48 medical institutions at work in Berar during 1899, the same as in the two previous years. Of these, eight are hospitals wholly maintained by the State. The total number of patients under treatment was 331,698, against 325,379 in 1898. In in-patients there was an increase of 522, and in out-door patients of 5,797. Of the in-patients, 3,740 were cured and 299 died, which gives a death-rate of 65 per 1,000. Malarial fevers continued to head the list of diseases from which relief was sought, nearly a fifth of the total patients were treated under this head; diseases of the eye and diseases of the digestive system came next in order. The number of surgical operations was 11,104, against 11,704 in 1898. Of these, 10,907 were cured and 34 were fatal. The decline in surgical work was attributed to the exclusion from the list, under instructions of the Director-General, Indian Medical Service, of certain minor surgical procedures.

The work of the Lady Dufferin Hospital for women and children at Amraoti showed some improvement during the year under report. The number of in-door patients rose from 143 in 1898 to 151, and the out-door patients from 5,913 to 6,847.

Lunatic Asylums.

Bengal.

At the five asylums in Bengal (viz., Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,131 lunatics, including 220 fresh admissions and re-admissions, were under treatment in 1899, being a decrease of 48 on the number of the previous year. In the course of the year under notice 110 patients were discharged as cured, and 27 as improved or otherwise, and 87 died. Compared with the figures of 1898, the number discharged was more by 56, and the mortality by 14. At the end of the year there were 889 persons still under detention, or 22 less than at the close of 1898. There was a marked improvement in the health of the inmates of the asylum, the average daily number of sick being 86, against 105. The death-rate was, however, higher, being 96·3, against 79·1 per 1,000 of average strength. The cause of insanity was traceable only in 102 of the 220 fresh admissions, and 44 of these were ascribed to ganja smoking. The results of the working of dairy farms at the asylums were fairly satisfactory. At Dullunda there was a profit of £55 as compared with £43 in the previous year. At Dacca the dairy was less profitable than in the previous year. The dairy farm at Berhampore also worked with better results and showed a small profit.

In the Bhowanipur Asylum, containing European and Eurasian patients only, the inmates during 1899 numbered 54, or one more than in the previous year. Of this number 35 were under detention at the beginning of the year, and 19 were subsequently admitted. In the course of the year 5 patients were discharged cured, 7 were transferred to the care of friends, 4 died and one was despatched to Europe as still insane, leaving 37 under confinement at the close of the year. As regards the health of the patients during the year, there were only 6 admissions to hospital, against 5 in the previous year, and 4 deaths, against 2.

North-Western Provinces and Oudh.

The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the North-Western Provinces and Oudh in 1899 numbered 1,349, including 319 fresh admissions during the year, against 1,290 in 1898. Before the close of the year 162 patients were

discharged, of whom 124 were reported as cured, 38 were made over to friends, 72 died, and 2 escaped, leaving 1,115 under treatment at the end of the year. The health of the asylum population showed improvement, the total mortality fell from 87 in 1898 to 72 in 1899, there being a marked decrease in all except Agra. The scheme for a large central institution at Agra, under the charge of a whole-time Superintendent, mentioned last year, remained for a time in abeyance pending the decision of the question whether the site of the asylum would be wanted for a combined railway station. That question having been decided in the negative the work has been resumed.

Punjab. The total number of lunatics in the Lahore and Delhi lunatic asylums in the Punjab during 1899 was 607, including 183 fresh admissions, against 558 in 1898. Both asylums are reported to have been overcrowded throughout the year, and the number remaining at its close is the highest yet recorded. The overcrowding is, however, fortunately of no moment now as the new Central Lunatic Asylum for the whole of the province at Lahore has been completed, and the patients from both the old asylums have been moved into it. At the end of the year the number was reduced to 457 by the discharge of 114 patients, 65 as cured, 27 made over to friends, and 15 otherwise discharged, and 35 deaths. As regards the health of the inmates of the asylums, the number of admissions to hospital during the year was 416. In Lahore the cases fell from 423 in 1898 to 327, and the number of deaths was 27 or 90·3 per 1,000 of average strength, practically the same as in 1898 when the mortality was 26 or 90·8 per 1,000. In the Delhi Asylum the admissions into hospital rose from 47 in the previous year to 89, but the deaths fell from 14 or 107·1 per 1,000, to 8 or 57·1. No special diseases were present in any unusual degree except pneumonia, from which there were 22 cases at Lahore or one more than in 1898. In the Delhi Asylum also, pneumonia cases rose from 4 to 7. Of the total number of admissions in more than one half (96) the cause of insanity was unknown.

Burma. The Rangoon Asylum is the only one in the province of Burma, and has accommodation for 404 insanes. During 1899 there were 462 patients in the asylum, including 117 fresh admissions, and the total was reduced at the close of the year to 365 by the discharge of 67 patients for different causes, and the death of 30. The general health of the inmates appears to have been good; the admissions to hospital rose from 153 to 173, and the deaths fell from 41 or 119·2 per 1,000 of average strength to 30 or 83·3. More than two-thirds (21) of the inmates who died were in bad or indifferent health at the time of admission to the asylum. The Inspector-General reports that "out of 117 admissions during the year a cause of insanity was assigned to 57 only or 49 per cent. Although every case where the cause of insanity was unknown was referred back for further information, and considerable pains taken to ascertain the previous history and habits of the patients, yet in most instances failure was the result."

Central Provinces. In the two asylums of the Central Provinces (Nagpur and Jubbulpore) there were 395 lunatics under treatment during 1899, an increase of 11 on the number in 1898. In the course of the year 41 patients were discharged as cured or otherwise, and 14 died, leaving 340 still under treatment at the end of the year. There was a satisfactory improvement in the health of both asylums. The admissions to hospital at Nagpur fell from 205 to 69, and at Jubbulpore from 100 to 93. The decrease at Nagpur was due mainly to the fall in cases of influenza from 129 in 1898 to 1 in 1899. Of the total 14 deaths, Nagpur recorded 11, being in the ratio of 63·6 per 1,000 of average strength, against 24 or 104·6 in 1898. Seven of the 11 deaths in this asylum were due to dysentery and debility. At Jubbulpore there were 3 deaths, being in the ratio of 19·4 per 1,000, against 7 or 45·8 in 1898. Of the 69 admissions during the year, 23 were returned as due to unknown causes.

Assam. There is only one lunatic asylum in the province of Assam, and this is situated in Tezpur. The total number of lunatics under treatment in the asylum during 1899 was 147, the same number as in the previous year. Of these, 22 were fresh admissions. At the close of the year the patients in the asylum were reduced to 119, 18 of the total number having been discharged, 1 escaped, and 9 died. The health of the inmates was satisfactory. Among the 147 inmates 57 were admitted to hospital, as compared with 86 in 1898. The number of deaths was, however, more by four than in 1898, and the death-rate rose from 40·3 per 1,000 of average strength to 71·1. It is explained that three of the deaths were non-preventible, and deducting these there remain only six deaths out of a daily average of 126·47, against five in 1898 out of a daily average of 123·98. The causes of insanity were unknown in 11 of the 22 new admissions.

Madras. At the commencement of 1899 there were 577 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 151 fresh cases were admitted, bringing the total population up to 728, or 14 more than the number in the preceding year. In the course of 1899 there were 115 cases of discharge, and of these 101 were cured or improved. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. On the whole there was more sickness among the patients than in the previous year, but all three asylums were free from epidemics during 1899. The daily average sick rose from 75 to 81, and the deaths from 46 or 79·3 per 1,000 of average daily strength, to 59 or 101·1. Of the total 59 deaths the Madras Asylum contributed 51, giving a death-rate of 117·7 per 1,000 on an average strength of 433, against a ratio of 75·2 in 1898. The death-rates of the other two asylums, Vizagapatam and Calicut, were 28·0 and 77·2 per 1,000 respectively, against 82·7 and 97·2 in the previous year. The increase in the mortality in the Madras Asylum was mainly due to the bad state of health of new admissions, 18 being so admitted, and of these three died within one month and seven within three months of admission. Of the 151 fresh admissions, the causes of insanity were unknown in 53 or 35·10 per cent.

Bombay. The total population of the six lunatic asylums of the Bombay Presidency (Colaba, Ratnagiri, Poona, Dharwar, Ahmedabad, and Sir Cowasji Jehangir, Hyderabad) was 1,114, including 303 fresh admissions, against 1,043 in 1898. In the course of the year 224 patients were discharged, 89 of them as cured, and 86 died, leaving 804 under treatment at the close of the year. There was slightly less sickness in the asylums than in 1898, the daily average sick having decreased from 41 to 37, but the deaths rose from 55 or 69·9 per 1,000 of average strength, to 86 or 108·2. Of the 86 deaths, 20 were due to dysentery, 18 to phthisis, and 8 to Bright's disease. The Colaba Asylum recorded the highest mortality of 53 deaths, or 168·2 per 1,000 of average strength, which was nearly double the rate recorded in the previous year, viz., 86·7.

Medical Schools.

Bengal. The number of medical schools open in Bengal during 1899–1900 was nine, or two less than in the previous year. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided. The college is affiliated to the University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the four unaided schools follow their own standards for private practice. The total number of pupils attending the various medical schools in the province was 1,582, as compared with 1,709 in the previous year.

The students of the medical college are required to undergo three University examinations during their five years' study, viz., the Preliminary Scientific examination at the end of the second year, the first L.M.S. or the first M.B. examination at the end of the third year, and the second L.M.S. or second M.B. examination at the end of the fifth year. The number of students at the College at the beginning of the session in 1899–1900 was 591 (including 16 women), against 576 in the preceding year. As regards the examinations, 161 candidates were successful out of a total of 431 (including one woman), the successes being at the rate of 37·35 per cent., as compared with 48·76 per cent. in 1898–99. Of the 161 successful candidates, only 11 out of 81 passed the Preliminary Scientific L.M.S. examination, 70 (including one woman) passed the first, and 35 the second L.M.S. examinations; 22 passed the Preliminary Scientific M.B. examination; three passed the first and two the second M.B. examinations.

The Campbell Medical School had 291 pupils (including 27 women) on its rolls at the end of the session. Of this number 19 males and 3 women passed the final examination for the diploma.

At the Dacca Medical School there were 191 pupils on the rolls (including 6 women). Nineteen students, all males, passed the final examination.

The Temple Medical School, Patna, had 165 students (including 5 women) on its rolls at the end of the session. At the final examination 23 candidates passed.

At the Cuttack Medical School the number of pupils at the close of the session was 112 (including 9 women). Ten candidates out of 17 passed the final examination.

North-Western Provinces and Oudh. The number of pupils attending the Agra Medical School in 1899–1900 was 244 (including 56 women), or 14 more than in the preceding year. The work of the students (male and female) is reported to have been diligent and satisfactory. The results of the final

examination of male students show that 43 out of 47 candidates passed. Fifteen of the 17 military students in the first or final class passed, and 28 of the 30 civil students passed. Of the students in Class II., comprising second-year military and third-year civil, private, and Rajputana pupils, all the 11 military pupils and 33 out of the remaining 47 pupils passed the first half professional examination.

As regards the examination of women students, the whole of the first-class, viz. nine, obtained their diplomas, and 17 out of 30 passed their class examinations, as compared with 14 out of 27 in the preceding year.

Punjab. The average attendance at the Lahore Medical College and School was less by 14 as compared with that of 1898–99, viz., 429 against 443. Of these 191 (including 5 women) were in the College, and 238 (including 2 women) in the Medical School. The results of the year's examinations show that for the Preliminary Scientific Examination, 19 out of 26 candidates passed. In the first L.M.S. and M.B. examinations, only 18 candidates out of 50 passed, against 32 out of 66 in the previous year, and in the second L.M.S. and M.B. examinations 28 out of 50 passed, against 21 out of 52 ; in all 65 out of 126, or 51 per cent. were successful. In the final examination for the hospital assistant diploma 67 passed out of 71, or 94 per cent.

The Medical School for Christian women continues to make progress and to do good work at Ludhiana. The object of the institution is "to provide a thorough medical "training, under fully qualified Christian women, for those Christian women and girls "who wish to prepare themselves for medical mission work." At the end of 1899 there were 58 students on the rolls, or 32 more than in the previous year ; of these 21 belonged to the Medical classes, four to the Compounders' classes, 17 to the Dais' classes, and the rest to the Nurses classes.

Madras. The number of students at the Madras Medical College (including the School Department) during 1899–1900 was 441, of whom 31 were women students. In the Hospital Assistant Department, consisting of 180 pupils, 70 appeared for the final examination, and 50 passed. The results of the several University examinations in medicine were again satisfactory, 44 having passed out of 66 candidates entered, against 26 out of 57 in 1898. In the College Department there were 65 regular students, including one woman student, reading for the M.B. and C.M. degree, 16 reading for the L.M.S. degree, and 14 casual students.

The Board Medical School at Nellore having been closed, the only other medical school at work during the year was the Prince of Wales' Medical School, Tanjore. At this there were 36 pupils on the rolls, all of whom were being prepared for the Hospital Assistants' Certificate. Fourteen candidates appeared for the final examination and 9 passed.

Bombay. The attendance at the Grant Medical College, Bombay, rose from 340 in 1898–99 to 368 (including 22 women) in 1899–1900. For the first University examination in medicine 149 candidates presented themselves, of whom only 87 qualified ; and for the second examination in medicine only 32 passed out of 89 candidates. For the final examination for the degree of L.M.S there were 54 candidates, and of these only 14 passed, 3 qualifying in the first class and 11 in the second. There were 38 military medical pupils, and of this number 10 passed their final examination, and were promoted to the grade of military assistant surgeons.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The average number of students on the rolls was 224, and the results of the examinations were satisfactory.

VII.—SANITATION.

In Calcutta progress continued to be made in the improvement of bustees, or clusters of Native huts. In the matter of water supply there is, as last year, nothing to record but the ordinary progress of the existing system. The average daily consumption of filtered water was 20,681,822 gallons, equal to nearly 34 gallons per head of population for the town proper, and nearly 21 gallons for the suburban area. In the course of the year the distribution pipes were slightly extended, bringing the total length up to 315·64 miles. The total number of premises connected reached 28,953. A great advance was made during the year in increasing the supply of unfiltered water. The mileage of unfiltered water mains in the towns and added area rose from 130¼ miles to 155 miles. The consumption of unfiltered water was 9,687,500 gallons, or nearly double the quantity consumed in the previous year; the daily consumption per head of population was slightly over 21 gallons against 11 gallons in the previous year. Improvements in the sewage and storm water outfalls of the town and suburbs, and the provision of a system of sewers for the suburbs were in hand. Various reconstructions and improvements were made in the sewerage system which at the close of the year had a length of over 200 miles, and the number of premises connected with the system was 30,670, of which 502 connections were made during the year. The presence of plague in an epidemic form rendered necessary a large amount of disinfection work, and for this purpose a staff of five European doctors with a considerable number of inspectors, was retained. It is reported that the policy of relying entirely on disinfection was successful, and that practically all cases of plague were reported. **Bengal.**

The municipalities of the interior of Bengal spent nearly 45 per cent. of their income on sanitation as compared with nearly 46 per cent. expended in the previous year. In addition a further sum of £20,300 was contributed by private individuals for sanitary works. The most important work was the completion of a portion of the flushing scheme of the Patna municipality. The new water-works at Berhampore were opened during the year, and were reported to be most successful and much appreciated by the inhabitants. The towns in which drainage schemes have been carried out numbered six, exclusive of Calcutta, and nine towns have improved water-supply.

The Sanitary Board held three meetings during the year, and continued as usual to advise the Government and local bodies on the important sanitary projects of the year. Among these were schemes for the improvement of the water supply of Dacca and Bhagalpur, and drainage projects for Manicktolla, Siwan, Dinajpore and other places. A preliminary estimate of £12,250 was also given for a scheme for increasing the water-supply at Darjeeling, and a proposal to supply Patna with water was also under consideration.

In the North-Western Provinces and Oudh the municipalities expended 35 per cent. of their aggregate income on water supply, drainage and conservancy. Nine towns, Agra, Allahabad, Benares, Cawnpore, Lucknow, Meerut, Mussoorie, Dehra Dun, and Naini Tal, are now furnished with waterworks and pumping machinery; these towns contain about one-third of the municipal population of the province. At Agra the water supply arrangements were being repaired and improved during the year; in Benares the large sewerage works were in progress; in Cawnpore a new sewerage scheme was laid before the Sanitary Board; and in Naini Tal the new water supply was practically completed. Sanitary notebooks have been introduced in 22 districts. **North-Western Provinces and Oudh.**

The Sanitary Board met four times in the course of the year. Among the more important matters that engaged their attention was the analysis of the water from municipal waterworks. In nearly all cases the water was found to be pure; but the enteric microbe was detected in a sample of water from the Agra cantonment in time to prevent any ill results.

In the Punjab the municipal towns spent over 24 per cent. of their income on sanitation in the year 1899. Water supply or drainage works were either completed, in progress, or under consideration in fourteen of the most important towns. The water **Punjab.**

supply works at Simla were practically completed during the year, and work was begun on the Delhi extension scheme and other less important projects. Important works of this character were under consideration in Bhiwani and Dharmsala. Not much progress was made during the year with the construction of drainage works, and operations were suspended at Delhi owing to lack of funds. Several important projects were, however, under consideration, including a scheme for Umballa, estimated to cost nearly £7,000, and an extension scheme for Simla. Preliminary operations were in progress in connection with the Rawalpindi scheme, of which the estimated cost is £9,800. Private individuals also spent sums aggregating £5,100 on the construction of minor sanitary works during the year 1898–99. The system of village sanitary notebooks is in force in many villages, and is found to be of considerable value. Rewards are offered to village headmen who have shown conspicuous interest in the sanitation of their villages, and a few villages were recommended for such grants during the year.

The Sanitary Board met seven times during the year, and discussed several sanitary matters of more or less importance. The appointment of a Sanitary Engineer for the province was under the consideration of the Government.

Burma. No sanitary work of any importance was undertaken in Burma during the year. The municipalities spent £133,300, or nearly 34 per cent. of their income on water supply, drainage, and conservancy; these figures include the ordinary sanitary work of Rangoon, which cost £101,200, or 45 per cent. of the municipal income, but they do not include the large expenditure on the reclamation works. The recently appointed Sanitary Engineer submitted six water supply schemes, of which the following three were of importance:—Bassein, to cost £26,800, Minbu £6,700, Akyab £26,600. Progress was made with the water supply projects for Moulmein, Maymyo, and the Meiktila and Rangoon cantonments, and an important scheme for the improvement of the Rangoon water supply, to cost £70,000, was revised by the Engineer during the year. No large drainage scheme is at present in progress. Village sanitary notebooks are in general use, and by their aid permanent sanitary records are to be kept. In Rangoon £19,200 were spent on the reclamation of the eastern portion of the city, making the total so spent up to date £122,500. The Lanmadaw portion is still very insanitary, and reclamation work will, it is hoped, shortly be begun there. A scheme for the removal of rubbish in East Rangoon, put into operation during the year, gave good results. The drainage of the city is on the Shone system, and worked satisfactorily. Additional precautions were taken during the year to prevent a breakdown in the machinery. It has been decided to dispense with the Royal Lake as a reservoir for the water supply.

The Sanitary Board was practically non-existent during the year, owing chiefly to official changes and departures, but proposals for its reconstitution were under consideration.

Central Provinces. The municipalities in the Central Provinces expended over £27,000, or 40 per cent. of their income, on sanitation in the year 1899. The water supply works in Jubbulpore and Khandwa were advanced, and those in Wardha and Bhandara were completed; the drainage of the town of Jubbulpore was improved at considerable cost, and a project was under consideration to utilise the water from the outfall drain for the manuring of cultivated land in the neighbourhood of the town. The Harda water-works scheme was again in abeyance, owing to want of funds. Two new villages were brought under the Village Sanitation Act during the year.

Owing to famine, there was only one meeting of the Sanitary Board during the year, and to this cause also is referred the scanty progress in filling in the village inspection notebooks, which have been started in all districts. The famine was also the cause of the short results in respect of the sanitary maps which have been prepared with a view to the collection of vital and sanitary statistics; the introduction of this system has been postponed until the new census figures are available.

Assam. Excluding six towns which have no separate incomes of their own, the municipal authorities in Assam spent nearly 43 per cent. of their income on sanitation in the year 1899. No extensive sanitary work was undertaken during the year, but in almost all municipalities small sums were spent on improvements to the drainage and water supply systems. The sanitary improvements effected in rural tracts were chiefly in the direction of providing a purer water supply by the construction of masonry wells and the excavation of tanks at some of the larger villages; six tube wells were sunk in the Kamrup district. Sanitary inspection books were kept up in selected villages, but owing to a

lack of interest in sanitary matters on the part of the village officials the books are in many cases of little value.

No formal meeting of the Sanitary Board was held during the year, but the Government of India having invited attention to this matter, meetings of the Board have since taken place and will be continued in future.

In the Madras Presidency the district municipalities allotted 53 per cent., and the district boards 7 per cent., of their income for sanitary purposes. A large portion of this expenditure was on conservancy, but the allotment out of municipal incomes for water supply altogether amounted to £49,500 in addition to that of Madras city. The extension of the water-works at Conjeeveram and of pipe lines in Tanjore were completed in 1899, and the water supply scheme for Tirupati, which was estimated to cost £15,400, was also finished. Seven water-supply schemes were prepared and submitted; schemes for the water supply of Coonoor and Tuticorin, and for the extension of water-works at Trichinopoly and Cuddapah were sanctioned by Government. Besides these, drainage projects for the Ootacamund bazaar and Kumbakonam were under consideration. The advance noted in 1898 in respect of conservancy was checked by the financial uncertainty caused by the presence of plague. Village sanitary inspection report books were in general use in 19 out of the 22 districts of the Presidency. Madras.

In Madras city a sum of £32,000 was expended on sanitation during the year, the chief item being £27,000 on conservancy. The work of taking levels and framing estimates for the city drainage was begun during the year. The Mylapore drainage system, recently completed, worked satisfactorily, with the exception of the bursting of some cement pipes. An incinerator was completed and brought into use, and over 22,000 cartloads of rubbish were destroyed. The quantity of water supplied from the Red Hill Lake was about 5 per cent. greater than in the previous year; but the level of the lake was lower at the close of the year than at the beginning.

The Sanitary Board scrutinized plans and estimates for one provincial, 34 municipal, and 79 local fund works, of the estimated cost of £128,900. Proposals for 17 other schemes were also considered by the Board; and six new standard type designs of minor sanitary works were approved for issue.

In Bombay City the gravitation portion of the Mazagon sewage works was completed during the year, as were also the surface drainage works in the Kamatipura district. Progress was made with the supply of machinery, &c., for the Parel and other sewage districts, and other important drainage works were at various stages of progress. Owing to the deficient rainfall, the water in the lakes from which the city takes its supply was affected both in quantity and quality, but the supply was sufficient. The vexed question of surface water disposal and sub-soil drainage continued to engage the attention of the Corporation at close of the year. Mr. Santo Crimp, who was called in to advise on the subject, submitted his report, and steps were being taken to give effect to his recommendations. Bombay.

In the other municipalities of the Presidency over 49 per cent. of the income was allotted for sanitary purposes, and 10 per cent. by the local boards, though in neither case was the full allotment spent. The whole expenditure on sanitary purposes was £178,600. Of the municipal sanitary expenditure, 20 per cent. was spent on the improvement of water supply, 43 per cent. on conservancy, and the rest on improvement of town sites, markets, provision of tanks, &c. The large expenditure on plague precautions checked the prosecution of sanitary works; a drainage scheme at Ahmedabad, water-works at Hyderabad, and water supply and drainage projects at Poona, were under consideration; but until the pressure of plague and famine has passed away funds are not likely to be available for their execution. The Bombay Village Sanitation Act was introduced in five other villages during 1899, and was abolished in four, making a total of 300 villages now under its provisions. The Act provides for the establishment of a sanitary committee or a sanitary board, consisting of members chosen by the collector of the district or by the Local Government, to supervise sanitary matters. Village sanitary inspection books were in use in 3,225 villages.

The Sanitary Board gave advice concerning several projects, including the Poona drainage scheme and water supply scheme for the city, and the military proposals regarding the sanitation of the Kamatipura section of the Sadar bazaar at Poona.

The municipalities of Berar spent 48 per cent. and the district boards about 17 per cent. of their income on sanitary improvements in 1899. No new works of importance Berar.

were in progress during the year. In the municipalities of Karinja and Buldana expenditure on drainage schemes had been sanctioned, but operations were stopped by the famine. A drainage scheme for Ellichpur municipality has been under consideration. The District Sanitary Boards met once at each of the six headquarter stations. The sanitary survey of selected towns and large villages made fair progress, and the number of towns now surveyed is 37, and of villages 1,127, leaving two towns and 4,116 villages still to be surveyed. The suggestions made for improvements, as a result of the survey, caused the expenditure of £1,500 during the year by district boards, but in many cases they could not be put into effect owing to lack of funds.

India Office,
November, 1901.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1899.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1899.

(Surgeon-General Robert Harvey, M.D., C.B.)

European Troops.

Sickness and Mortality in 1899.—The health of the European army of India was again much better than in the preceding year, and only the invaliding rate was greater than the corresponding decennial ratio. The year on the whole was hot and dry with deficient rainfall. To these meteorological conditions was apparently due the fact that admission, death, and invaliding from malarial fevers were much reduced.

Year.	Strength.	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	Total Loss.
1889–98	691,080	1,468	89	16·49	28	44
1898	67,741	1,437	90	20·05	38	58
1899	67,697	1,149	73	12·75	32	44

The chief causes of admission were venereal diseases and ague. Among the diseases with increased admission rates were influenza, small-pox, tubercle of the lungs, and pneumonia. On the other hand, the admission rates from cholera, remittent fever, ague, enteric fever, simple continued fever, bowel-complaints, hepatitic affections, and venereal diseases were lessened. Venereal diseases caused 27 per cent. of the total sickness, and ague 20 per cent.

The chief causes of death were enteric fever and hepatic abscess. Among the diseases with increased mortality were small-pox, pneumonia, and circulatory diseases. On the other hand, the mortality from malarial fevers, enteric fever, cholera, dysentery, and abscess of the liver was lessened. Enteric fever caused 40 per cent. of the total deaths, and hepatic abscess 10 per cent.

The chief causes of invaliding were, in order, syphilis and gonorrhœa, malarial fevers, debility, disordered action of the heart, and dysentery: syphilis and gonorrhœa, especially, and malarial fevers, being far ahead of the others.

Commands.—In the following table the ratios of the four commands are placed side by side for comparison. Bengal had the highest mortality from heatstroke, tubercle of the lungs, and dysentry; the Punjab the highest from enteric fever, remittent fever, pneumonia, and other respiratory diseases; and Madras the highest from hepatic abscess. All the commands were more healthy than in 1898.

Ratios of Commands.

	Ratios per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.
I.—Strength	21,278	18,080	12,876	15,462	67,697
II.—Constantly Sick Rate	80·9	62·1	81·9	67·4	73·0
III.—Admission Rate of the Year—					
Influenza	7·1	1·9	27·5	8·7	10·0
Cholera...	—	·1	—	—	·01
Small-pox	—	·6	·2	·1	·2
Enteric fever	22·8	24·9	12·1	19·4	20·6
Intermittent fever	247·8	247·1	219·9	216·9	235·2
Remittent fever	7·0	15·3	7·1	9·0	9·7
Simple continued fever	30·4	32·0	38·5	28·8	32·0
Tubercle of the lungs	3·3	2·5	3·3	3·4	3·1

Ratios of Commands—continued.

	Ratios per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.
Admission Rate of the Year—*cont.*					
Pneumonia	3·8	7·6	2·6	5·9	5·1
Other respiratory diseases	19·2	27·2	28·7	22·9	24·0
Dysentery	32·4	18·0	30·8	20·0	25·4
Diarrhœa	18·0	23·0	5·6	21·3	17·7
Hepatic abscess	2·8	1·9	2·1	2·1	2·3
„ congestion and inflammation	18·0	13·9	22·8	14·3	17·0
Venereal diseases	364·9	226·7	397·8	273·6	313·4
All Causes	1,191·1	1,085·1	1,259·2	1,072·9	1,148·7
IV.—Death Rate of the Year—					
Cholera...	—	·06	—	—	·01
Small-pox	—	·06	—	—	·01
Enteric fever	5·50	6·64	3·03	4·66	5·14
Intermittent fever	·42	·33	·31	—	·28
Remittent fever	·09	·33	·16	·06	·16
Simple continued fever	—	·06	—	—	·01
Heatstroke	·75	·55	·23	·32	·50
Circulatory diseases	·66	·50	·39	·65	·56
Tubercle of the lungs	·89	·50	·39	·32	·56
Pneumonia	·47	1·16	·16	·78	·66
Other respiratory diseases	·14	·17	—	—	·09
Dysentery	1·08	·39	·62	·39	·65
Diarrhœa	—	—	—	—	—
Hepatic abscess	1·46	1·11	1·48	·97	1·26
All Causes	13·82	14·82	10·10	11·06	12·75

Geographical Groups.—The following table shows that, judging by the constantly sick rate, Gangetic Plain, Central India, and Burma Inland were the most unhealthy groups for the decennium, and Hills and Western Coast the most healthy; that the decennial cholera mortality was highest in Gangetic Plain, and lowest in Western Coast; and that enteric fever mortality was highest in the Hills, and lowest in Burma Inland. In 1899 all the ratios, except the enteric mortality of Southern India and the Convalescent Depôts, were lower than those of the decennium :—

		Ratio per 1,000 of Strength.												
		I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
		Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
1889-98	Constantly sick ...	95·2	97·8	91·8	103·0	94·5	90·8	99·1	93·7	80·2	86·2	78·7	87·8	89·3
	Death—Cholera ...	·15	·34	·78	4·32	·81	·75	1·46	·78	·07	·39	·31	·21	1·11
	Death—Enteric fever	3·67	2·01	3·26	7·80	8·16	7·32	9·31	5·15	3·15	3·27	19·13	5·02	6·54
1898	Constantly sick ...	86·4	78·6	80·8	102·4	95·3	95·2	99·1	97·7	82·7	86·8	77·9	95·6	90·0
	Death—Cholera ...	—	—	·84	·15	·78	—	—	—	—	·28	—	—	·21
	Death—Enteric fever	·82	·75	2·94	13·61	11·21	13·93	14·31	5·45	·66	3·12	14·30	3·48	10·17
1899	Constantly sick ...	73·0	77·5	85·7	85·7	75·3	59·4	78·3	78·4	69·8	79·7	54·7	79·1	73·0
	Death—Cholera ...	—	—	—	—	·08	—	—	—	—	—	—	—	·01
	Death—Enteric fever	2·49	1·36	1·90	6·02	6·90	6·48	9·10	4·01	1·86	4·70	4·20	5·20	5·14

In the following table the vital statistics of the groups for 1899 will be found placed side by side to facilitate comparison. The most unhealthy group was Bengal-Orissa. Burma Coast had the highest admission rate from influenza, simple continued fever, tubercle of the lungs, and venereal diseases ; Bengal-Orissa the highest from ague, dysentery, and hepatic abscess ; Indus Valley the highest from small-pox, remittent fever, and pneumonia ; Central India the highest from enteric fever and diarrhœa ; Southern India the highest from hepatic congestion ; the Hills the highest from rheumatic fever ; and the Convalescent Depôts the highest from respiratory diseases other than pneumonia.

Ratios of Geographical Groups.

	RATIOS PER 1,000 OF THE AVERAGE STRENGTH.												
	I. Burma Coast and Bay Islands.	II. Burma Inland.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII*a*. Hill Stations.	XII*b*. Hill Convalescent Depôts and Sanitaria.	India.
I.—STRENGTH	1,206	2,942	2,103	6,976	12,749	4,781	6,151	9,939	1,611	3,194	9,525	3,272	67,697
II.—CONSTANTLY SICK RATE ..	73·0	77·5	85·7	85·7	75·3	59·4	78·3	78·4	69·8	79·7	54·7	79·1	73·0
III.—ADMISSION RATE OF THE YEAR:													
Influenza	37·3	15·0	—	3·9	·5	2·1	—	36·1	—	·3	15·4	1·2	10·0
Cholera	—	—	—	—	·1	—	—	—	—	—	—	—	·01
Small-pox	1·7	—	—	—	—	2·1	·2	·1	—	—	—	—	·2
Enteric fever	5·8	4·1	8·1	22·4	24·6	14·9	31·9	20·0	6·8	20·4	25·5	22·0	20·6
Intermittent fever	187·4	383·1	658·1	195·7	267·5	276·9	230·9	209·5	148·4	274·9	103·6	216·7	235 2
Remittent fever	6·6	11·9	15·2	4·2	7·5	28·2	13·3	7·6	2·5	5·6	8·5	7·9	9·7
Simple continued fever ..	73·8	38·1	53·7	43·2	19·5	71·1	17·1	25·4	21·1	60·1	17·2	12·2	32·0
Rheumatic fever	·8	·3	—	·7	·8	1·3	1·0	1·2	1·9	·6	4·4	2·1	1·5
Tubercle of the lungs ..	5·8	1·7	3·3	3·0	3·5	2·7	2·0	2·2	5·0	2·8	1·8	3·4	3·1
Pneumonia	3·3	2·0	3·3	2·0	7·2	9·0	2·4	4·0	2·5	2·5	8·4	3·7	5·1
Other respiratory diseases	23·2	20·1	17·1	17·9	26·2	32·6	22·8	22·2	23·6	16·6	22·4	44·6	24·0
Dysentery	19·9	20·4	90·3	26·9	22·2	10·0	21·0	27·4	10·6	36·0	19·5	20·5	25·4
Diarrhœa	5·0	·7	20·9	17·2	23·5	17·6	23·6	14·8	19·2	11·3	18·9	15·6	17·7
Hepatic { abscess	—	3·7	8·1	2·6	1·4	1·3	1 8	2·0	1·2	3·1	2·5	2·1	2·3
Hepatic { congestion and inflammation.	28·2	20·7	16·6	17·3	17·9	6·3	14·5	15·3	16·8	31·3	12·7	23·5	17·0
Venereal diseases	401·3	398·0	275·8	382·7	305·0	234·5	322·5	381·3	341·4	375·1	222·0	257·6	313·4
ALL CAUSES	1,182·4	1,391·9	1,630·5	1,131·3	1,225·8	1,114·8	1,130·5	1,185·9	934·8	1,354·1	845·2	1,190·7	1,148·7
IV.—DEATH RATE OF THE YEAR—													
Cholera	—	—	—	—	·08	—	—	—	—	—	—	—	·01
Small-pox	—	—	—	—	—	·21	—	—	—	—	—	—	·01
Enteric fever	2·49	1·36	1·90	6·02	6·90	6·48	9·10	4·02	1·86	4·70	4·20	5·20	5·14
Intermittent fever	·83	·68	2·38	·14	·31	·42	·16	··	—	—	·10	·31	·28
Remittent fever	—	·34	·48	—	·39	·42	—	·10	—	—	—	·31	·16
Simple continued fever ..	—	—	—	—	—	—	—	—	—	—	—	·31	·01
Heatstroke	—	·34	1·90	1·15	·55	·63	·65	·30	—	—	—	—	·50
Circulatory diseases ..	—	—	·48	·43	·39	·21	·81	·40	—	·63	1·05	1·22	·56
Tubercle of the lungs ..	—	·68	·95	1·43	·63	·42	·16	·30	—	—	·42	·31	·56
Pneumonia	—	—	·95	·14	1·02	1·05	·16	·50	·62	—	1·36	·92	·66
Other respiratory diseases	—	—	·48	·14	·16	—	·16	—	—	—	—	·31	·09
Dysentery	1·66	—	4·28	1·00	·39	·21	·49	·50	—	·94	·52	—	·65
Diarrhœa	—	—	—	—	—	—	—	—	—	—	—	—	—
Hepatic Abscess	—	2·04	4·28	1·29	·86	1·05	1·30	1·11	·62	2·82	1·05	·92	1·26
ALL CAUSES	6·63	7·82	21·87	14·76	14·12	15·06	14·96	9·56	9·31	14·40	10·50	14·06	12·75

The percentage of dysentery and hepatic abscess to total admissions in 1899 was greatest in Bengal-Orissa ; of enteric fever, diarrhœa, and pneumonia in Hill Stations ; of simple continued fever and remittent fever in Indus Valley ; and of venereal diseases in Western Coast.

Stations.—The highest ratios amongst the large garrisons with a strength of over 1,000 were those of Peshawar (21·59), Lucknow, Umballa, and Bangalore (17·35). The first three were also in this black list in 1898, but their ratios in 1899 were greatly reduced, especially that of Peshawar. The Bangalore ratio, on the contrary, was higher than in 1898.

Regiments.—The statistics of individual regiments and of the different arms of the service show that the cavalry had the highest constantly sick and death rates, and an invaliding rate exceeded only by that of the artillery, which had the highest admission rate. The highest constantly sick rates in the various arms of the service were those of the 3rd Hussars, the 29th Battery, Southern Division, Royal Garrison Artillery, the 2nd Battalion, King's Own Yorkshire Light Infantry, and the 1st Battalion, Royal Warwickshire ; the highest death rates those of the 3rd Hussars, the 7th Battery, Eastern Division, Royal Garrison Artillery, the 72nd Battery, Royal Field Artillery, and the 1st Battalion, Royal Irish Rifles. This last was stationed at Dum-Dum and Calcutta after arrival in April from Natal, and its chief causes of death were dysentery, hepatic abcess, ague, and enteric fever. The principal loss of the 3rd Hussars at Lucknow was from enteric fever.

Principal Diseases : Influenza.—Sickness and mortality having been studied in their relation to India, to commands, to geographical groups, to stations, and to regiments, it will be convenient now to discuss the statistics of some of the chief diseases. At the end of 1898 and the beginning of 1899 influenza was falling. It began to rise in February, and reached its maximum for the year in May, though there was a rise again in October and November. The following table shows the increase of total in 1899. It also shows the monthly progress and the annual fluctuations of the disease since 1890, the first epidemic year :—

Period.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Per 1,000 of strength.
1890	—	3	473	1,451	248	69	13	2	3	—	—	1	2,263	33·4
1891	1	—	1	16	77	91	112	29	20	2	2	21	372	5·5
1892	113	53	354	241	57	4	32	8	—	—	—	—	862	12·7
1893	1	—	—	15	4	—	—	—	—	—	—	1	21	·3
1894	7	9	12	70	101	30	7	7	—	2	—	—	245	3·4
1895	14	7	52	156	66	35	17	1	5	13	23	165	554	7·8
1896	262	65	140	30	12	7	3	3	88	128	50	20	808	11·5
1897	12	10	31	9	11	30	8	8	—	54	87	12	272	4·0
1898	7	19	82	213	162	57	6	—	1	—	9	8	564	8·3
1899	6	10	145	136	167	79	42	11	1	12	59	6	674	10·0
Total	423	176	1,290	2,337	905	402	240	69	118	211	230	234	6,635	

The actual maximum of the individual years of the ten occurred in various different months, but over the ten-year period as a whole the greatest numbers of cases occurred in April and March, and the smallest numbers in August and September : 83 per cent. of the whole in the first six months of the year, and only 17 per cent. in the last six months. Geographical Groups I, II, V, VI, IX, XI, XII*a*, and XII*b* were attacked both in 1898 and in 1899 ; Group VII, which had escaped in the two years preceding, was affected in 1899 ; Groups IV and VIII, which had suffered in 1898, escaped in 1899 ; while Group X was spared in both years, as well as in the four years 1894-97. It is not

known why this last group, which contains the European garrison of Bombay, has been so long free from influenza. Twenty-eight stations were attacked in 1899, against twenty-five, over a dozen out of the twenty-eight having had no cases in 1898. Belgam, Ahmednagar, Chakrata, Ranikhet, and Rangoon had the greatest numbers of cases. At these stations the outbreaks were single and compact, except for a certain amount of tailing off in the case of Belgam. The returns deal, of course, only with those cases which were admitted into hospital. The only death returned as directly due to influenza occurred at Ahmednagar, where the disease, it is stated, was of a severe type. The Jhansi report mentions that the diagnosis between influenza and simple continued fever is variable; and the medical officer at Rangoon states that some of the cases returned as ague were probably influenza. In none of the reports is any mention made of the use of bacteriological methods as an aid to the diagnosis. In Europe it has been discovered that the bacillus may occur in the sputum or cling about the nose and pharynx for weeks and months. The microbe has also been found in the cerebro-spinal fluid and in endocarditic valve lesions.

Cholera.—General questions regarding the etiology, spread, and prevention of cholera, and the circumstances, so far as they are of importance, attending the occurrence of cases in 1899, will be found discussed under Chief Diseases (pages 91–101). The amount and proportion of cholera were much less than in the previous year, and the ratios were much below those of the decennium, as may be seen in the following table. There was only one case in the whole of the European army in India, and never before in the records of this office has so low a mortality appeared. The returns which come next are 12 cases in 1874, 16 in 1893, and 17 in 1898 :—

Period.	Admissions.		Deaths.	
	Number.	Per 1,000 of Strength.	Number.	Per 1,000 of Strength.
1889–98	1,053	1·5	764	1·11
1898	17	·3	14	·21
1899	1	·01	1	·01

The one case occurred in the 11th Battery, Royal Field Artillery, at Meean Meer, at a time when cholera was attacking the native troops as well as the non-military population.

Small-pox.—The admission rate from small-pox rose from 0·03 to 0·2, and the death-rate from 0·00 to 0·01. There were 14 cases with 1 death, against 2 cases without death. The ratios were still much below the decennial ratios of 1886–95. Peshawar and Nowshera, both in Group VII., had respectively 7 and 3 cases; but out of these ten, only one died. All the men affected bore marks of vaccination. The man who died was of intemperate habits, and was attacked with confluent small-pox. The disease was prevailing in the bazaars at the time, and the roads were very dry and the air dusty.

Ague, Remittent Fever, Simple Continued Fever, Malta Fever.—Ague gave rise to over 20 per cent. of the admissions from all causes. The admission ratio was low, and the death ratio lower than in the preceding year. The lowness of the ratio was probably connected with the dryness of the year.

Period.	Intermittent Fever.		Remittent Fever.		Simple Continued Fever.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1889–98	360	·22	14	·51	42	·02
1898	394	·30	33	·37	43	·06
1899	235	·28	10	·16	32	·01

The following table shows that the group-incidence of ague was somewhat abnormal in 1899, as it had been in 1898, this being apparently connected with the fact that the monsoon rainfall of the east was abundant, that of the west and south deficient :—

Period.	Ratio per 1,000 of Strength.												
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
1889–98...	178·9	387·1	404·9	226·4	458·3	731·8	482·9	251·1	157·4	139·9	252·4	285.7	359·8
1898 ...	56·3	171·4	603·5	314·8	550·3	766·3	499·1	320·6	115·0	278·1	224·8	43·0	394·0
1899 ...	187·4	383·1	658·1	195·7	267·5	276·9	230·9	209·5	148·4	274·9	103·6	216·7	235·2

In the Bengal-Orissa group the most malarious stations were Barrackpore and Dum-Dum. The medical officer in charge at the former says that it is situated on low-lying alluvial soil with insufficient drainage, surrounded by rice cultivation and stagnant tanks ; but he acknowledges that the drainage has been greatly improved by the measures completed in 1898, and to that attributes the reduction of malaria in 1899. At Dum-Dum the soil is said to be water-logged. In some station reports the inter-fluctuations in the diagnosis of ague, simple continued fever, and influenza are noticed. The most malarious months of 1899 were August, October, and September, and the least malarious, as usual, February. The rise of malaria and its acme were both earlier in the year than usual. This appears to have been connected with the distribution of the rainfall.

Remittent fever was much reduced in 1899. The disease was most prevalent at Peshawar, Attock, Delhi, and Shwebo. At Shwebo the disease, often of a severe type, was in all cases contracted in the very malarious forests to the north-east of the station, where, towards the end of the rains, the natives had been dying in numbers of the same disease. Remittent fever in 1899 was most prevalent in August and May, and least prevalent in February. Eleven men died, and ten of the bodies were examined. In five no very definite lesions were discovered ; in one there was pneumonia, said to have supervened ; in one there was an abscess of the liver ; in one there was an abscess between the spleen and the liver ; in one there was yellow lymph on the brain, especially under the medulla and pons ; and in one the lymph glands, especially the mesenteric, as well as the spleen, were enlarged and soft, and Peyer's patches were stripped of their epithelium. At Barrackpore cases suspected of being enteric fever, but not re-acting to Widal's test, were returned as remittent fever, even though they did not respond to the exhibition of quinine.

Simple continued fever was also much reduced. It was most prevalent at Nowshera, Aden, Madras, Port Blair, Peshawar, and Thyetmyo. The causes mentioned at these and other stations are sun, heat, over-exertion, want of acclimatization, especially when combined ; chill, exposure, constipation, errors in diet and drink. Some of the cases were suspected to be enteric fever, or malarial fever, or influenza, or Malta fever, or some yet-undifferentiated fever ; and the employment of the serum test is said at Rawalpindi to have led to the smallness of the number of cases returned as simple continued fever. One man, whose case was returned as simple continued fever, had been 84 days under treatment. He had a stricture of the urethra ; and the examination of his dead body revealed the presence of a single abscess of the liver, and "dysenteric ulcers" of the large intestine and of the lower third of the ileum. In 1899 most simple continued fever was registered in July, and least in January. The admissions from simple continued fever fell from 1886 to 1891, rose in 1892, fell up to 1894, rose to 1897, fell slightly in 1898, and fell considerably in 1899. The height of all the fever ratios in 1897 and 1898 and their fall in 1899 were apparently connected with the progress and cessation of field service on the

frontier. From 1886 to 1894, while simple continued fever was on the whole falling, ague and enteric fever were on the whole rising. If the causes of simple continued fever be as given above, it seems easy to understand why in the European army men are most attacked and women least, and why natives suffer less than Europeans, though there is perhaps also in the native military hospitals a tendency to call most short mild fevers ague.

1890–99.

Groups.	Simple Continued Fever.						
	Admissions.		Ratio per 1,000.		Troops and Prisoners.	Admissions.	Ratio per 1,000.
	European Troops.	Native Troops.	European Troops.	Native Troops.			
Group I.—Burma Coast and Bay Island.	1,139	84	86·4	4·2	European Army { Men ...	26,890	39·0
„ II.—Burma Inland...	1,304	497	48·7	8·8	European Army { Women	670	21·3
„ III.—Assam	*	130	*	7·4	European Army { Children	1,884	32·9
„ IV.—Bengal and Orissa ...	709	200	31·2	6·6			
„ V.—Gangetic Plain and Chutia Nagpur.	3,153	182	44·2	2·8	Native Army ...	13,521	10·6
„ VI.—Upper Sub-Himalaya	5,639	602	41·7	3·9	Prisoners ...	24,773	23·4
„ VII.—North-Western Frontier, Indus Valley, and North-Western Rajputana.	1,661	1,823	35·3	12·2			
„ VIII.—South-Eastern Rajputana, Central India, and Gujarat.	2,738	2,021	43·1	15·1			
„ IX.—Deccan...	3,123	2,661	32·7	13·4			
„ X.—Western Coast ...	1,181	975	78·9	30·8			
„ XI.—Southern India ...	2,045	1,881	58·3	22·4			
„ XII*a*.—Hill Stations	1,903	1,759	22·8	10·2			
„ XII*b*.—Hill Convalescent Depôts and Sanitaria.	524	*	15·5	*			
India	26,890	13,521	39·0	10·6			

* No Troops.

It is curious to note that both European and native troops have high ratios in the Western Coast and Southern India groups.

Only one case of Malta fever was returned from Kalabagh; but the medical officer does not mention the case in his "Transactions." Just at present a number of cases of Malta fever are being discovered in India both among Europeans and natives; but the experience of the past should warn those in authority, while encouraging the research, to exercise a certain amount of reserve in the acceptance of at least the earlier results. After all, serum diagnosis is still in its infancy, or is just emerging therefrom.

Enteric Fever.

The Goulstonian lectures for 1900 by Horton-Smith form the most valuable recent contribution to the literature of enteric fever on its scientific side. Some of the more general conclusions of Horton-Smith are as follows:—

The typhoid bacillus can always be found in the stools in the early periods of the disease. It can also be demonstrated always in the Peyer's patches and the mesenteric glands. It does not, however, remain limited to these situations, but very soon, and in all cases, passes into the blood (from which it can often be isolated), by means of which it is distributed to the most diverse organs. Thus it can be always found in the spleen and in the liver. It gives rise in the skin to the typical eruption. It is in most cases present in the marrow of the bones and in the bile. It is frequently present in the urine, and is not uncommonly found in the kidneys. Occasionally, also, it may be detected in the lungs, and sometimes in other organs . . . Any conception of the disease which regards it merely as affecting the alimentary canal only can no longer be maintained. On the contrary, so far from considering it as an intestinal disease pure and simple, we should rather look upon it as a *modified form of septicæmia*. It is septicæmia in that always and in all cases the bacilli pass into the blood and then into the various organs, and in that the symptoms, excepting as far as they are intestinal, are referable to the poisons there produced. It is a modified form, however, in that in nearly all

cases there is a definite local and primary disease, whence the secondary dissemination of the micro-organism takes place. Looked at in this way, we have a ready explanation of the fact that the severity of the disease bears no relation to the number and character of the intestinal lesions. For just as a fatal septicæmia may originate in a scratch, so one or two small typhoid ulcers may be quite sufficient to allow the entry of the micro-organism and the development of the disease.

Urine.— The subject of the urine in its relations to the enteric bacillus was fully treated of in last report. It may, however, be added that Horton-Smith considers the bacilluria to be due, not to continuous renal excretion of bacilli, but to the multiplication in the bladder of a stray bacillus or two from the kidney.

Fæces.—Remy claims by the use of a new medium to be able to isolate the enteric bacillus, and to differentiate it from the colon bacillus. In the examination of 23 cases he found the bacillus once on the 3rd, 4th, 6th, 13th, 14th, 21st, 22nd, and 30th days; twice on the 42nd and 45th days; three times on the 10th and 16th days; and four times on the 5th and 9th days. His experience is that the bacilli are few at first, more numerous in the second week, fewer again in the third and fourth weeks, and disappear gradually or, at least, cease to be detectable by present methods. All the bacilli from the stools were of the same type, re-acting negatively with regard to the production of indol and fermentation, and positively towards enteric serum. He regards the finding of the bacillus in the stools as the only certain sign of enteric fever, and the only sign which in a doubtful case is sufficient of itself to establish a positive diagnosis.

The Roseola.—The efficiency of the method of Neufeld, noticed in last report, for obtaining the bacillus not only from the roseola, but also from the general circulation, has been confirmed by subsequent observers. But Eug. Fraenkel has gone a step further with regard to the roseola. He exercised roseola spots in five cases, and kept them, with proper precautions, at 37° C. for 18 hours, in order to cause the probably sparce bacilli to multiply. In stained sections he was then able to find little heaps of enteric bacilli lying in the papillary portion of the cutis; and thereby to demonstrate that the roseola is not merely a hyperæmia, but a local lesion caused by the bacillus.

Soil. Dust.—In a leading article on the endemic fever of English towns, with special reference to the report of the Medical Officer of Health of Chichester, the *Lancet* makes some remarks interesting to sanitarians in India, of which a couple of sentences may be quoted :—

> Specific pollution of drinking water, milk, shell-fish, ice-cream, and the like may, indeed, now and then have caused an increase of the customary amount of enteric fever; perhaps a particular period of sustained fever prevalence has seemed to have been started by an outbreak which was traceable to infected food or drink; but the appearance of inenteric fever year after year in excessive amount has quite certainly not been occasioned by recurring exposure to infection by such agencies . . . To admit that enteric fever may be locally spread by the way of the diverse and obvious opportunities of fection afforded by recently and specifically polluted surface soil, brings us, it is to be feared, little nearer to obtaining the causation of endemic enteric fever . . . A satisfactory explanation seems to require the further proposition that in certain cases the typhoid bacillus must be capable of maintaining for weeks and months an active existence in soil.

Barr, too, remarks that while fresh water supplies have lessened or almost abolished widely-spread epidemics, yet as an endemic in many large centres of population enteric fever is as prevalent and of as severe a type as it was a quarter of a century ago.

In connection with the above it may be noted that Horton-Smith, in the lectures referred to, after mentioning that there is no proof that the enteric bacillus can multiply outside the body, and that many outbreaks may be explained by the prolonged infectiousness (see the report for 1898, paragraph under "Urine") of persons apparently restored to health after an attack of the disease, goes on to say that if it be remembered that the bacillus has great power of resisting the effect of desiccation, remaining alive, it may be, for over a year in the dried condition, it becomes easy to understand how bacilli eliminated from the body may later pass into the atmosphere in the form of dust, and cause disease at long periods after every fresh source of infection has been really removed; that these facts should, in many cases at least, render unnecessary a belief in the actual growth of the bacillus outside the human body; but that the question is one which the future alone can finally settle.

Water. Filters. Chemical Purifiers.—A case is reported from Europe in which a battalion, after taking part in certain manœuvres, developed 30 cases of enteric fever, and the enteric bacillus was found in the well from which water had been supplied to this battalion only. At Cuxhaven Dunbar could not find the enteric bacillus in the water of a well round which cases of enteric fever had occurred, but found it in a well surrounded by a population that appeared free from the disease. But a week after, 20 cases occurred

in this second population. It has been estimated that the enteric bacillus disappears when in competition with the saprophytic organisms of water in about two weeks ; but it is difficult to find it in water at any time. Hankin's method, which was fully described in last report, was tried by Hilbert in Germany, who reported that it was good so long as the colon bacillus was not present at the same time. To this criticism Hankin has replied, pointing out that Hilbert in his laboratory experiments omitted to acclimatize his enteric microbes to life in water ; that in his examination of suspected waters he did not test enough samples of each ; that he did not wait till he had become a practised worker with the method before reporting on it ; and, finally, that Adami in Canada has reported favourably on the method from practical experience. ' Hilbert having also asserted that "only a fraction" of the cultures submitted by Mr. Hankin to Professor Pfeiffer were acknowledged by the latter to be true enteric, Mr. Hankin referred to Professor Pfeiffer, and obtained a reply that the expression referred only to some cultures he had seen in Bombay, and that "nearly all" those sent to Berlin were true enteric. So great is the difficulty of finding the enteric bacillus in water—or, at least, so rarely is it found—that Professor Carl Fraenkel advises those who send specimens to him for examination not to wait for the result, but to go on with the precautions they would have taken if the bacillus had never been discovered. Endeavours are therefore made to find other bacteriological criteria of probable danger in water ; but here the difficulty of forming a judgment is greatly increased by the occasional occurrence of eberthiform (enteric-like) and colriform bacilli, *i.e.*, of microbes which form a graduated series between the enteric bacillus on the one hand and the colon bacillus on the other, and partake in degrees of the characters of both ; so that it is a laborious task to identify not only the enteric but even the colon bacillus. In fact, some practical bacteriologists attempt to avoid the difficulty by condeming all waters in which such intermediate forms, or the colon bacillus itself, occur, at least in any considerable number, constantly or in spates ; believing that they are not only signs of danger, but actually themselves constitute the danger. But, just as an outbreak of enteric fever sometimes occurs in a community whose water-supply appears bacteriologically pure, so occasionally a water reported dangerous by the bacteriologists fails to produce an outbreak. One difficulty is that while some of these intermediate forms appear to be water-bacteria, no one has succeeded in reconciling either the enteric or the colon bacillus to a permanent aquatic life. Vaillard having stated that he had seen the enteric bacillus present for long periods in very pure water, Löffler replied that if so it must have been continuously introduced into the water ; for in his experience the bacillus only lived for 24–48 hours in very pure water, and for not more than 15 days in natural water, though it might live longer and even multiply in contaminated water. Again, Lunt did not succeed in acclimatizing the normal intestinal colibacillus to water. However, it is conceivable that the acclimatization-process may nevertheless be worked out in the better furnished and more slowly working laboratory of nature. Levy and Bruns state that if the suspected water be "enriched" by the addition of peptone and salt and by incubation at 37° C. for 48 hours, and then be injected in respectively appropriate quantities into guinea-pigs, rabbits and mice, the result to the animals will show whether any colon or proteus bacilli present were virulent, and therefore signs of impurity, or non-virulent, and therefore signs of purity. They state that animals never die from the injection of *pure* water. The results of Weissenfels, just published, do not, however, support those of Levy and Bruns. Pakes affirms that a water which shows a great variation in the number of bacteria present from time to time must be considered just as unsafe as one which shows variations in chemical composition ; that the presence of the colon bacillus in the water from a deep well in any quantity is sufficient to condemn it ; that drinking water not from a deep well, if it contains the colon bacillus in 20 c.c. or less, should be condemned ; if it contains the coli bacillus in any quantity between 20 and 50 c.c., should be looked upon as suspicious ; if it contains the same organism in from 50 to 100 c.c., should be regarded as slightly suspicious ; if the bacillus is found only in quantities greater than 100 c.c., may be looked upon as probably safe ; if no colon bacilli can be obtained from two litres, may be considered absolutely safe. The presence of the *Bacillus enteritidis sporogenes* too has been proposed as a test, but the researches of Hewlett show that the exact value of the test cannot yet be appreciated. The use of a chemical test for cystine has been introduced by M. Causse, who considers the occurrence of cystine in a water to indicate the presence of the germs of typhoid fever. The purification of water is attempted by the aid of heat, by the addition of chemicals, or by the use of filters. Vincent at the Paris International Congress stated that the Pasteur and Berkefeld filters were about equal ; but that even when sterilized they do not give a water rigorously and constantly aspetic, and that every few days they must be sterilized

anew. With regard to the Berkefeld filter, Lunt reports that although the filtrate obtained was not absolutely sterile after the first day, yet neither the colon bacillus nor the enteric bacillus could be detected in the filtrate over periods of 39 and 26 days respectively, although they were easily found in the water outside the filter for 39 and 26 days respectively. In India, as elsewhere, a good deal is now known of the practical inconveniences and dangers of the use of filters, and of the extreme care which they require. Weyl in Germany and A. Calmette in France have strongly supported the claims of ozone to be the best and most successful purifier of water, even on the large scale ; and Plagge and Schumburg have published a useful short paper on all the best or most frequently used chemical methods, including the well-known permanganate and bromine processes. From France come favourable reports of potassium permanganate, so much used also in India.

How little after all is really known about the bacteriology of water, and about the necessity and the best means for the sterilization of water, is shown by the report of a discussion on these subjects by eminent bacteriologists of more than one nation at Paris on the 16th of August, 1900.

Milk, Eggs.—Hesse, agreeing with the previous results of Theobald Smith, points out that if while milk is kept at 60° C. for 15 to 20 minutes, a pellicle is not allowed to form, the bacilli of enteric fever, cholera, diphtheria, plague and tubercle are all destroyed ; while Macfadyen and Hewlett found that in their apparatus 30 seconds at 70° C. killed the enteric, tubercle, and diphtheria bacilli, and the staphylococcus. Bucco asserts that the enteric bacillus is able to enter into an unbroken egg in twelve hours, and to keep its vitality therein for four or five days.

Flies.—Some results of Hankin's with regard to flies are quoted below. Vaughan has published 53 conclusions derived from a study of the enteric fever of the American army camps, and one of them is that flies undoubtedly served as carriers of the infection. Chiene also speaks of dust and flies as disseminators of the disease in South Africa.

Colibacillus fever, Tropical fevers.—Both Burney Yeo and Rho mention the fact or the possibility of the occurrence of cases indistinguishable clinically from enteric fever, but caused by the colon bacillus. Rho considers that in hot countries medical men attribute too much to malaria and too little to enteric fever ; and believes that nearly all "climatic" fevers and common continued fevers are enteric fever. It has, too, been pointed out by Osler and others that even in a malarious locality a continued fever irresponsive to quinine is in all probability enteric fever, and should be considered such until proof to the contrary is obtained. Osler and Rho regard the co-existence of enteric fever and malarial fever in the same patient as excessively rare.

Some cases were quoted in last report. Rho mentions 1 more, and Kerr 5, in which both the plasmodium and the bacillus were present. The case reported by Yarr is incomplete, the proof given of the presence of enteric fever being entirely clinical. McNaught has lately published two cases.

Enteric fever and dysentery.—Washbourn, Richards and Washbourn, Sir William Stokes, and Watkins Pitchford have all reported from South Africa cases of the co-existence of, or very close connexion in time between, enteric fever and dysentery. Similar cases in India are noticed below, and have been noticed in previous reports. The dysenteric bacillus isolated by Flexner in the Philippines belongs to the enteric group.

Second attacks.—Nearly every year this report cites one, or it may be two, cases in which second attacks of enteric fever have occurred in one patient. Remlinger in the case of 628 French soldiers attacked by enteric fever obtained in 16 a certain and in 5 a doubtful history of previous attack ; four cases came under his own observation ; and he is able to cite 31 more observed by others.

Incubation.—The question of the length of incubation of enteric fever constantly comes up in India in connexion with the decision as to where cases originated—locally, or on the march, or in another station. Vaughan puts it as from something under 8 days to any time within 8 weeks ; another writer as from 10 days to 3 weeks. Engel went over all the literature available to him, but could only find 88 cases that could be safely used, and even of these a few showing periods of 1, 2, 33, 42, 45 days were ultimately rejected as doubtful. But incubation periods of from 4 to 32 days were regarded as fully established, the most frequent being 14 days, then 18, then 21, then 8.

Cause of relapses. Cause of falling ill.—Horton-Smith, in the lectures already referred to, has some interesting remarks on the causation of relapses in enteric fever. Put shortly, the idea is that at a time when all the enteric bacilli have not yet been destroyed in the patient, an absorption of toxines (*e.g.*, those of the colon bacillus, Gaertner's bacillus, or of the proteus) takes place from the intestinal canal (auto-intoxication), giving the enteric bacillus a fillip, and enabling it to acquire fresh virulence and to re-invade the patient's organism. But the same explanation might be applied to the original succumbing of the patient to the enteric infection ; for it may be that, in some cases at least, disease only follows when, as the result of some trifling derangement of the bowel, the soil has already been prepared by the absorption of toxic products, or, in other words, by auto-intoxication. Ord, however, offers quite a different explanation of relapses—self-re-infection of the patient by putting his soiled fingers into his mouth.

Opinions of medical officers.—As usual, a factor most commonly insisted upon by medical officers was recent arrival in India of regiments, or of drafts, coupled with youthfulness of the men. In a few cases it is stated that particular regiments or barracks were especially attacked. Proximity to sewage irrigation, to filth pits, to an incinerator, to a latrine, to disused latrine-ground, to an enteric ward, and conveyance by flies and dust to the mouths of men, to food, and to cook-house water, are the chief points mentioned in this connexion. In other stations, too, dust and flies are mentioned as probable agents of infection, and the prevalence of enteric fever is connected with the dryness of the year and the frequency of dust storms. The medical officer at Peshawar believes that systematic road-watering would be a powerful preventive ; while the medical officer of Agra points out that in June enteric fever was rare, though dust-storms were frequent, no cases occurring between May and August. At Quetta one man was believed, and believed himself, to have been infected by the dust inhaled in pulling down an old latrine ; while at Chakrata the site of a removed latrine was used for playing quoits by the men of a regiment affected. The water, aërated water, milk, sweetmeats, food, &c., obtained in bazaars, brothels, and villages were, as usual, strongly suspected by nearly all medical officers. At Deesa one man admitted for soft chancre developed enteric fever in hospital, and he was found to have bazaar sweetmeats concealed in his bed. While the barracks at Agra were furnished with purified well-water, infected pipe-water was supplied to the bazaar, and the latter had to be placed out of bounds. The same measure was adopted at Poona on account of the plague, and at Umballa and Peshawar, and it is said to have reduced the amount of the disease. Some patients acknowledged the drinking of water from unauthorised sources in the station ; some of water direct from the tap, instead of the specially purified water provided for them ; while others out shooting in the jungle, or walking in fields or villages, or at exercise, or in camps of exercise, or rambling about khuds in the hills, or travelling by railway, drank water or milk evidently impure, or not known to be pure. For the 47th Battery, Royal Field Artillery, at Ferozepore, a polluted well-water, containing the colon, but not the enteric bacillus, was by mistake taken into use on the 11th May. Its use was discontinued on the 14th May. The dates of admission of enteric fever cases in this battery during the year were—April 21 ; May 5, 7, 12, 16, 19, 22, 23, 24, 26 ; June 16 ; and December 30. The cases which occurred early in January at Bangalore were apparently associated with the presence of the enteric bacillus in water used in the horse-lines. At Agra, while every care was being taken of the drinking water, it was found that aërated waters were being manufactured from unboiled water of the frequently specifically impure pipe supply. Not only was the bazaar at Shwebo supplied with a foul water from the King's tank, but during the rains that tank overflowed into the reservoir set apart for the storage of the drinking water of the troops, and the men were suspected of drinking the mixture direct from the tap. The impure water of the lake at Meiktila was considered likely, directly or indirectly, to be the source of the infection. One patient at Dagshai had drunk morning and evening for a month milk procured from a native in the floor of whose house a cesspit was found. The combined result of seven stations was that 50 cases occurred among total abstainers and 90 among non-abstainers, or 36 and 64 per cent. respectively. But, as their average annual strengths cannot be obtained, no conclusion can be drawn as to the relative liability of those two classes. Some medical officers lament that the purificatory measures applied to the water of late years have not produced the hoped for result ; while others state that the history of enteric fever in their stations shows that the water supply is not there the source of the disease. That the cavalry and artillery at Bangalore suffered more than the infantry was believed to be due to the fact that their barracks were near an open sewer, and a filth depôt, and a lucerne

crop irrigated by sewage ; and perhaps also to the vicinity of the horse-lines, with their dust, and flies, and contaminated water. The effluvia of the Ahmednagar filth-pits were believed by the medical officer of that station to have had something to do with the causation of the disease. In a good many cases patients dated their illness from a chill after being heated, from over-exertion or exposure, from fatigue, from exposure to the sun. In other cases the attack was preceded by the eating of water-cress, of tomatoes, of tinned salmon, which caused diarrhœa ; while the medical officer of Colaba mentions that men had been seen eating small shell-fish picked up on the polluted foreshore. At Quetta recent arrival there was considered to be a factor in the local causation of cases. Medical officers frequently noted, especially in the case of hill stations, that the disease must have been contracted before arrival, either from impurities encountered on the march, or from a cause existing in the previous station ; so that the station where the disease was treated was not always the station in which it was contracted. Several cases of men new to India were noted by the medical officers of Meerut, Dagshai, Ferozepore, Khyragully, and Kalabagh, as having apparently contracted the infection on the way up country from Bombay ; and in two Calcutta cases the infection is said to have been probably contracted in South Africa. Some officers, as usual, state their belief that enteric fever and venereal disease are contracted in the same haunts. The contamination of latrines by ambulant cases, and the subsequent dissemination of the disease by flies and dust, are among the possible dangers noted ; and in one case the attack was ushered in by a severe, possibly pythogenic sore throat, in another by diarrhœa lasting 14 days before the man reported sick. At Fatehgarh, Cawnpore, Umballa, Meean Meer, Murree, Madras, Rangoon, Mandalay, Poona, Agra, and Ahmednagar, also, the water supply is said to be liable to contamination ; and the possibility of danger in the carrying of the water, either from the mode of carriage or from the distance to be traversed, is noted at Allahabad, Dinapore, Cawnpore, Ranikhet, Jutogh, Kasauli, Cambellpur, Ghora Dhaka, Bellary, and Ramandrug. That dangerous arrangement, a double water-supply, still obtains at Calcutta, Agra, Madras, Wellington, Secunderabad, Thayetmyo, Shwebo, Satara, and Nasirabad. The fact that the simultaneous supply of two waters of different degrees of purity may occasionally be the only permanent or temporary possibility, does not make it any less undesirable. With regard to only six stations, it is stated that the water needed, and received, no purification before issue for consumption. Usually the water was boiled, sometimes in Larymore boilers, and was treated with potassium permanganate, alum also being occasionally used. The use of Pasteur filters is also mentioned, especially with reference to the aërated water factories. At Agra, Chakrata, and Wellington the process of sterilization is said to have been improperly carried out, and was therefore useless, or worse than useless. Though it is practised in many stations, only a few reports mention the incineration of excreta. It appears that the perfect incinerator has not yet been found, and experiments are being continued. As usual, some medical officers recommend the dismissal of the native cooks, and the transfer of the cooking to the hands of specially trained soldiers. The enteric bacillus was detected in samples of water from Agra, Wellington, Bangalore, and Neemuch, to which, according to Mr. Hankin's annual report, should be added Chakrata ; an enteric-like bacillus in water from Umballa ; the *bacillus coli* in water from Lucknow and Ferozepore. Some other medical officers state that the result of bacteriological examination was negative, or that no examination was made, while some do not notice the point at all. With regard to Wellington, the medical officer points out that while 300 persons drank of the infected water only two got the disease. In several stations the Grünbaum-Widal reaction was used in the diagnosis of cases, and at Rawalpindi the bacillus was frequently cultivated from the spleen. The medical officer at Fort Lahore notes that no women, no children, no members of the permanent staff were attacked. That the women and children at Sialkot were completely exempt seems to the medical officer to point to the bazaar-haunting habits of the men as a factor in causation if it were not for the difficulty that the officers and ladies are not exempt. At Wellington there were no cases among the women and children, though one of the men attacked was a married man. Both at Barrackpore and at Agra it was noticed that civilians, using the same water, suffered much less in proportion than soldiers. In the extracts given below it is claimed that the measures adopted at Cherat and Bangalore were successful in reducing the amount of enteric fever, and those put in force at Quetta were also accompanied by a great diminution of the number of cases. Cases in which placing the bazaars out of bounds is said to have been efficacious have been given above. Calcutta, Roorkee, Poonamallee, Rangoon, Port Blair, and Mandalay are reported usually to enjoy comparative immunity. The explanation given for Calcutta is the good water-supply ; for Roorkee the presence of grass and the consequent absence of water-defiling

dust ; and for Mandalay good luck and the unattractive taste and colour of the impure water. The decrease at Jullundur is ascribed to the selection of wells, the boiling and permanganating of the water, and sending away of young susceptible men to the hills ; at Peshawar to the bazaar being out of bounds, and to the men not having been anxious to visit it on account of one of their number having been murdered therein by a fanatic ; at Meiktila, possibly to the fact that the drinking water has been boiled since April 1896. The reduction at Mhow the medical officer confesses himself unable to explain. The personal element among men equally exposed to infection was emphasised by the medical officer at Wellington, while at Agra the harvest and the rise and the fall of the river were found to be contemporary with the maxima of the disease. The French idea of the possibility of the transformation of the colon bacillus into the enteric bacillus was considered at Mhow. Some medical officers considered that enteric fever after a previous prophylactic inoculation was comparatively mild. Out of the 1,392 cases of enteric fever which occurred throughout the army of India in 1899, 24 are noticed as having declared themselves among patients in hospital or among attendants. Out of these 11 were in hospital for early venereal disease, except that in one the enteric fever was observed before the venereal disease (gonorrhœa), and eight for other diseases, and five were attendants on enteric fever cases. The number of attendants attacked was low as compared with the number in each of the two years preceding. Cases of second attack were reported from Ranikhet, Jhansi, Chakrata, Madras, and Bangalore. The first attack of the Ranikhet man had been at Quetta nine months before. Fhe Jhansi medical officer records that there was no *post-mortem* evidence of the former attack, which was said to have occurred at Subathu in 1898. The man affected at Chakrata was said to have had a first attack in 1897, and had also been inoculated in January, 1899. The first attack in the Madras case occurred six years ago, while the Bangalore man had had his first attack, with relapse, in August, 1898. In two of the fatal cases at Ranikhet the *post mortem* appearances were abnormal. In the first the only intestinal lesion was a perforating ulcer, $\frac{1}{4}$ of an inch in diameter, in a Peyer's patch, about $2\frac{1}{2}$ feet from the lower end of the ileum ; in the other the only intestinal lesion was a non-perforating ulcer, the size of a split pea, in a Peyer's patch about 6 inches above the lower end of the ileum. Cases in which enteric fever and dysentery were closely connected in time were observed at Agra, Chakrata, and Meiktila. At Agra and Meiktila the dysentery immediately preceded the enteric fever ; at Chakrata the dysentery supervened on recovery from enteric fever. A case each of enteric fever at Jubbulpore, Dalhousie, Bangalore, Rawalpindi and Poona was complicated with abscess of the liver. The Bangalore case was not examined *post mortem* : in three of the other cases the abscesses were multiple. Again, in six cases returned as abscess of the liver from Bareilly, Ranikhet, Umballa, Poona, Ahmednagar and Kirkee, the origin of the abscesses was with more or less certainty suspected to have been the intestinal ulceration of enteric fever. In only two of these cases was there actual ulceration at the time of death ; in two there were scars and signs of the preceding enteric fever, while in two there was nothing to go upon but a history of recent enteric fever.

Medical officers also reported on the outbreaks of 1899, of their supposed causation, especially of their connection with polluted drinking water, of the measures considered to have been effectual in preventing or checking the disease, and of any other points of interest brought forward. From the following table it will be seen that there was at last a reduction in the amount of enteric fever in India :—

Commands.	Year.	Enteric Fever.		
		Admissions.	Ratio per 1,000 of strength.	Difference.
Bengal	1898	824	41·1	− 18·3
	1899	485	22·8	
Punjab	1898	895	48·7	− 23·8
	1899	451	24·9	
Madras	1898	143	11·6	+ ·5
	1899	156	12·1	
Bombay	1898	513	35·1	− 15·7
	1899	300	19·4	
India	1898	2,498	36·9	− 16·3
	1899	1,392	20·6	

No general explanation can at present be offered as to the rise in Madras and the fall in the other commands, especially as Madras received 2,422 fewer, and Bombay 98 more, fresh arrivals than in the preceding year. In the Bengal command 24 out of 33 stations shared in the decrease of ratio, chief among them being Shahjahanpur, Jubbulpore, Muttra, Agra and Lucknow ; in the Punjab command 19 or 20 out of 30, especially Fort Lahore, Cherat and Nowshera, Kalabagh on the other hand showing a great increase. The disease decreased in only seven out of 20 Madras stations, and in six out of 22 Bombay stations, but the decrease in the Bombay station at Quetta was very great :—

Years.*	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1898	2	...	...	...	2	5	37	56	48	60	21	1
1899	.	...	3	...	...	..	1	7	6	7	2	...

the total being reduced from 232 to 26. This great reduction at Quetta may fairly be considered, at least provisionally,* as due to the detailed and painstaking measures adopted in consequence of the outbreak in 1898, though it will be noticed that the season of maximum prevalence was the same in both years. The number of fresh men arriving in drafts was much the same as in the preceding year.

Enteric fever in 1899.—There was a great decrease of both morbidity and mortality from enteric fever in 1899. The admission ratio fell from 36·9 to 20·6 and the death ratio from 10·17 to 5·14, a difference of 16·3 and 5·03, and a percentage reduction of 44·17 and 49·46 respectively. The reason for this is to be found, perhaps, not so much in the climatic conditions of the year, as in the facts that the influx of drafts from England was much smaller than usual, and that there was no field service. There were 1,392 admissions and 348 deaths, against 2,498 and 689 in 1898. The average number of men constantly sick from enteric fever, excluding those at Lundi Kotal, was 213, and the average duration of a case, with the same exclusion, was 56 days. The total loss of service due to the disease was about 77,818 days, the men at Lundi Kotal being excluded from the calculation, because the requisite data were not furnished for them. At the stations of Barrackpore, Bareilly, Chaubuttia, Solon, Rawalpindi, Peshawar, Colaba and Quetta, at least, the Grünbaum-Widal test was employed as a means of diagnosis. The results of the preventive inoculations with dead bacilli after the manner of Wright is commented on under General Remarks (page 150).

Fever mortality.—The following table shows an increase in total fever and in enteric fever, and a decrease in "other fevers" progressive through three decennia. It will be observed that the increase in enteric fever began suddenly in 1878, the year in which the short service system probably began to affect India, and the year which saw the commencement of the Afghan war :—

Fevers.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1870–79.
Enteric Fever ...	1·59	1·62	1·87	1·34	1·70	1·44	1·82	1·60	3·64	3·59	2·03
Other Fevers† ...	2·56	1·74	1·38	1·11	·86	1·04	·59	·56	1·43	2·96	1·42
Total of both ...	4·15	3·36	3·25	2·45	2·56	2·48	2·41	2·16	5·07	6·55	3·45

Fevers.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1880–89.
Enteric Fever ...	3·63	2·64	2·55	2·40	2·74	3·41	5·08	3·76	3·75	6·11	3·67
Other Fevers† ...	2·88	·72	·68	·46	·64	·72	·84	·74	·73	·81	·92
Total of both ...	6·51	3·36	3·23	2·86	3·38	4·13	5·92	4·50	4·48	6·92	4·59

* There has been an outbreak again in 1900.

† Intermittent, remittent, and simple continued fevers.

Fevers.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1890–99.
Enteric Fever ...	4·91	5·73	5·52	5·29	5·75	6·72	6·31	9·01	10·17	5·14	6·45
Other Fevers* ...	·64	·61	1·42	·70	·56	·59	·50	1·02	·73	·45	·72
Total of both ...	5·55	6·34	6·94	5·99	6·31	7·31	6·81	10·03	10·90	5·59	7·17

* Intermittent, remittent, and simple continued fevers.

During the three years of the Afghan war, 1878–80, the ratio was high. Afterwards it was lower for four years, but it never again fell to the low level of the previous decennium. It rose in 1885–86 with the onset of the Burmese war, and again very steeply and suddenly in 1889 for some unknown reason. After this it was lower for a time, but never returned to the level of the 1880–89 decennium. There was another sudden increase in 1897–98 with the outbreak of the Afridi war. With each of these sudden rises of enteric fever there was also a rise of "other fevers," which might be held to point to the hardships of war if it were not for the case of 1889. It looks as if the persistent increase of the disease were due to the continuous supply of susceptible subjects, and perhaps to the greater abundance of germs derived from cases; and as if a sudden aggravation by field service or some other cause were never quite recovered from, the disease indeed falling, but never again to its former level. This would appear to mean an increase in the amount of virus ready for work throughout the land; and for such a state of things the only remedies would be the artificial immunization of the soldier and the total destruction of *all* the excretions of enteric patients. At the same time it must not be forgotten that the progressive increase of enteric fever was partly due to the gradual recognition of the frequency of the disease in India.

Enteric Fever in the geographical groups.—The following table shows enteric fever in the geographical groups in the decennium 1889–98, and in the last two years :—

Admissions per 1,000.

Period.	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.
1889–98 ...	9·3	5·0	11·6	31·2	29·4	19·6	32·3	20·2	7·6	15·4	33·9	14·8
1898	7·3	4·5	19·3	44·1	36·6	29·6	47·1	25·7	2·6	19·3	59·7	20·3
1899	5·8	4·1	8·1	22·4	24·6	14·9	31·9	20·0	6·8	20·4	25·5	22·0

It shows that Groups V, VI, VIII, and XII*a*, are apt to have high ratios of admission from enteric fever; and Groups II and X, and, to a less extent, I and IV, low ratios. It also shows that in most of the groups enteric fever morbidity was unusually low.

Enteric fever in stations.—The following shows the distribution of enteric fever in those garrisons which had an average strength of over 1,000 in 1899, with the decennial ratios for reference :—

Stations.	1899.		Decennium, 1889–98.	
	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
Chakrata	64·4	8·70	36·8	7·99
Rawalpindi	38·4	7·37	28·6	7·88
Bangalore	36·6	7·43	20·3	3·90
Lucknow	32·6	8·76	40·2	9·50
Umballa	32·0	8·97	31·1	8·11

Stations.	1899.		Decennium, 1889–98.	
	Admission-rate.	Death-rate.	Admission-rate.	Death-rate.
Mhow	29·3	8·37	35·1	8·52
Ranikhet	29·1	4·85	36·5	6·13
Agra	27·2	8·23	48·6	13·60
Allahabad (including Fort Allahabad.)	26·4	8·79	34·6	9·36
Peshawar	25·3	9·87	30·1	12·89
Meerut	24·6	9·31	35·6	10·23
Secunderabad ...	16·8	3·14	25·2	6·03
Bareilly	15·5	3·11	40·5	10·12
Sialkot	14·4	3·85	33·0	7·27
Wellington	13·9	2·99	8·8	2·75
Kamptee	11·4	4·73	12·2	3·60
Quetta	10·8	2·08	30·7	6·99
Poona	9·0	2·12	18·1	5·02
Colaba (Bombay) ...	7·9	1·58	4·2	1·71
Belgam	7·1	3·56	2·9	·66
Aden	6·4	1·83	4·9	2·45
Rangoon	5·6	1·88	9·6	3·09
Fort William	3·6	·91	5·4	1·73
Fort Dufferin (Mandalay.)	1·0	—	6.1	2·16

The high position occupied by the decennial admission ratios of Agra, Bareilly and Lucknow will be observed, and the low position of the ratios of Belgam, Colaba, Aden, Fort William, Fort Dufferin, Wellington and Rangoon. The contrast between the 1899 ratios of Chakrata and of Mandalay is also striking. The reasons given by medical officers for the prevalence of enteric fever in, or the absence of enteric fever from, certain stations, including Chakrata and Mandalay, have been quoted above.

Enteric fever in regiments.—In regiments the admission and death-rates were, as in the two preceding years, highest in the cavalry; and next to them the artillery suffered most. The 47th Battery, Royal Field Artillery, was the only body of men that had an admission ratio over 100 per 1,000 and a death ratio over 40 per mille: in the 42nd Field Battery, though the admission was still higher, the death-rate was low. The 3rd Hussars had the highest cavalry admission ratio; and in the infantry the highest ratios were those of the 1st Royal Fusiliers, the 1st Northamptonshire Regiment, the 2nd Gordon Highlanders and the 2nd Welsh Regiment.

Enteric fever and age. Enteric fever and length of residence in India.—The general results of the relation of mortality from enteric fever to age and length of residence in India confirm those of former years; the relative liability to death from enteric was greatest in the age period 20–25 and in the first year of residence. The result of the relation of *admission* from enteric fever to age and length of residence in India is the same as that for mortality.

Enteric Fever and Season.—In the period 1889-98 as a whole the chief enteric months were April, May and August, and the months of least prevalence were January and February:—

Years.*	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000.
1889–98	754	641	1,034	1,982	2,243	1,615	1,716	1,986	1,684	1,060	1,037	1,224	16,976	24·6
1898 ...	201	165	164	332	400	219	197	238	163	124	171	124	2,498	36·9
1899 ...	111	44	84	246	229	123	96	138	111	59	·71	80	1,392	20·6

* The warning given at the end of the table of contents of the Annual Returns as to the months not being calendar months applies here also, except as regards the months of 1899.

In 1899 the greatest prevalence of enteric fever was in April, May and August; of simple continued fever in May, July and August; of remittent fever in May and August. Of the larger groups Gangetic Plain had maxima in January, April, August, and December; Upper Sub-Himalaya in January, April and December; Indus Valley in May and December; Central India in January, April, August and December; the Deccan in January, June and August; and the Hill Stations in April and September. There seems to be here some indication of a general seasonal influence.

Plague.—In the European army of India there occurred 7 cases of plague, with 2 deaths, against 9 and 2 in the previous year :—

	Admissions.	Deaths.
Poona	2	1
Kirkee	2	...
Ahmednagar	2	...
Deolali	1	1
	7	2

Besides these, 2 officers, 3 women and 4 children were attacked; one of the officers and the women and 2 children at Kirkee, the other officer at Poona, and the other children at Belgam and Deolali. In no case was the exact mode of acquisition traced, though, of course, the disease was present among the native population. It is not mentioned whether any of the patients had been on plague duty.

Scarlatina. Rubella.—Scarlatina gave 83 cases with 6 deaths, against 12 cases without death. Quetta had 25 cases with 1 death, and Kasauli 19 cases with 1 death. Of the remaining 17 stations affected, one had 9 cases, one 6, one 3, six 2, eight 1; and there was also 1 case among troops on the march. No station had more than 1 death. The Kasauli medical officer says that the disease was imported from Umballa, and in the Umballa report it is stated that all the cases there occurred in a draft from a hired transport in which cases had occurred. Eight other medical officers derive the disease from a transport with more or less certainty; and perhaps it was one and the same transport, the "Simla," which originated all or nearly all the Indian cases of 1899. At Poona the source of the disease could not be discovered, but the regiment which occupied the barracks in the preceding year had had cases. At Mooltan the first man attacked was a recruit from Dublin, and the first at Quetta was a boy who had been over a month in the country, the medical officer, however, suspecting the transport to have been the original source of the infection. The scarlatina of 1899 seems, therefore, to have been, at least for the most part, due to the importation of infection, and not to infection arising indigenously. The conclusion to be derived from a discussion in the medical papers on the subject of scarlatina in India is said to be that though it is certainly met with, especially in the hill stations, it shows very little tendency to spread, and quickly dies out, and that it sometimes attacks a few natives in a mild form. One writer asserts that scarlatina is epidemic only in countries where cow's milk (raw ?) is used: not in Japan or China, "where there are no cows," nor in India where mothers suckle long. But the explanation is not complete as regards Europeans in India. The microbiology of the disease is again under discussion. Twenty-one cases against seven of rubella were registered, nine at Mandalay, and the remainder at four other stations and on the line of march. Three of these stations returned also cases of scarlatina. There were no deaths from rubella. Some progress has been made in England in the differential diagnosis of rubella from the diseases which it most resembles, one class of cases being split off from rubella, and placed between it and scarlatina, and in Germany the necessity of distinguishing between true rubella and *erythema infectiosum* has been insisted upon.

Tubercle of the Lungs.—The admission rate from tubercle of the lungs rose from 3·0 to 3·1, while the death-rate fell from 0·58 to 0·56. The tables on pages 41 and 43 show that in 1899 the Bombay Command and the Burma Coast and Western Coast groups had the highest admission ratios. The annual reports for the stations where tubercle occurred in greatest proportion throw no light on the subject. The 16 cases returned as non-tubercular phthisis should probably be added to tubercle of the lungs. The identification of the tubercle bacillus is no longer so simple a matter as it once appeared, owing to the discovery of other acid-fast bacilli. Klein also has shown that young tubercle bacilli are sometimes not acid-fast. At the same time, by an improved technique, the tubercle bacillus can now be recovered from the fæces.

Respiratory Diseases.—Respiratory disease as a whole was much the same as in the preceding year :—

Period.	Respiratory Diseases.		Pneumonia.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1889–98	33	·80	4	·63
1898	29	·77	3	·61
1899	29	·75	5	·66

Of the commands, the Punjab had, as usual, the highest death-rate. As to groups, the greatest prevalence, excluding the convalescent depôts. was, as usual, in the Indus Valley. Mild bronchitis was the principal non-pneumonic affection.

Both the admission and the death-rate from pneumonia rose. Most of the cases occurred, as usual, in the north-west and in the cold weather. The five men who died at Peshawar were all more or less debilitated by previous attacks of ague, and in each case the fatal illness developed after the man's participation in the fatigues of route-marching. The medical officer suspects dust as being concerned in the causation.

Dysentery and Diarrhœa.—The admission and death rates from dysentery and from diarrhœa fell very considerably below the ratios of the previous year and those of the decennium :—

Period.	Dysentery.		Diarrhœa.	
	Admissions per 1,000.	Deaths per 1,000.	Admissions per 1,000.	Deaths per 1,000.
1889–98	30	·88	27	·07
1898	30	·78	27	·04
1899	25	·65	18	...

Dysentery was most prevalent, as usual, in the Bengal Command and in the Bengal-Orissa group. The same group and command had the highest percentage of dysentery in total cases, as may be seen in the tables on pages 41 and 43. It is usual for Bengal-Orissa to have a high dysentery ratio. The maximum month was August, and the maximum quarter July-September : the minimum month, February, and the minimum quarter, January-March. Barrackpore, Poonamallee, Dum Dum, Solon, Aden and Jubbulpore had very high ratios, especially the first three. The medical officer at Barrackpore is inclined to think that insufficient drainage is the cause of the prevalence of dysentery at that station, and that an extension of the present system would diminish it. He also notes that in spite of precautions taken for disinfecting the stools. two men admitted for other diseases apparently contracted dysentery in hospital. At Dum Dum most cases were admitted when the weather was exceedingly hot and damp. At Aden the cause was supposed to be chills contracted at the change of seasons.

In the Philippines the American Commission (Flexner, etc.) isolated a bacillus belonging to the enteric group, and considered to be probably identical with that discovered in Japan by Shiga. This bacillus reacted with the serum of dysentery patients, but not with enteric serum. The question of the causative relation of the *amœba coli* to certain forms of dysentery, those which from the beginning are subacute or chronic, is still undecided ; but there is no doubt that there are plenty of non-amœbic cases, and Flexner's bacillus was found in acute cases or in cases which were originally acute.

Hepatitis.—The admission and death-rate from hepatitis, including abscess of the liver, fell from 21 and 1·59 respectively in 1898 to 19 and 1·26 in 1899.

Venereal Diseases.—From venereal disease the admission rate for India was 313·4, against 362·9 in the previous year and 485·7 in 1897. In other words, in 1899 for every 1,000 men there were nearly 50 fewer admissions to hospital for venereal

disease than in 1898. All the commands shared in the decrease, but it was greatest in Bombay and Bengal. In 1899 there were 1,851·31 (against 2,201·81) men constantly sick in hospital from venereal disease—equivalent to about two regiments. The out-patient system reduces the number of men constantly sick in hospital. Excluding from the calculation men at Lundi Kotal, for whom the necessary data are not available, the average stay of a case of venereal disease in hospital was 31·89 days (against 33·31); and the total loss of service was about 675,728 days (against 803,661). There were 14 deaths (0·21 per 1,000 of strength), and 442 invalidings (6·53 per 1,000) directly due to venereal disease—against 17, or 0·25 per 1,000 of strength, and 569, or 8·40 per 1,000.

The only station ratio over 700 per 1,000 of strength was that of Saugor. The greatest increases of ratio (increases of more than 100 per 1,000) were at Ramandrug (strength only 16), Solon, Deolali, Fort Dufferin, Dinapore, and Shahjahanpur. In 26 stations (against 39) the admission-rate from secondary syphilis was over 100 per 1,000 of strength; the highest ratios, excluding stations of very low strength, being those of Deolali, Poonamallee and Chaubuttia; and in 18 other stations (against 47) it was over 75 per 1,000.

For India the ratio of primary syphilis *plus* soft chancre diminished by 24·5 per 1,000 of strength, the ratio of secondary syphilis by 15·2 per 1,000, and the ratio of gonorrhœa by 9·8 per 1,000; the percentages of possible reduction being respectively 16·9, 17·5 and 7·5. In 1899 the Madras Command had the highest ratio for primary syphilis *plus* soft chancre, and, as usual, for secondary syphilis; the Bengal Command had the highest ratio for gonorrhœa. To show how individual opinion influences statistics, and to justify to some extent the lumping together of primary syphilis and soft chancre in this paragraph, it may be stated that the medical officer at Belgam favours placing all primary venereal sores under soft chancre to begin with, while the medical officer of Meiktila would put them all provisionally under primary syphilis.

For increase of venereal disease causes assigned were re-admissions, garrison being at full strength, greater care in detection, influx of diseased women from another station, influx of diseased men from another station. Some of the explanations of decrease of venereal disease given were,—stricter action under the Contonment Act, the out-patient system, the more continuous and thorough treatment of patients (reducing re-admissions), the effect of cantonment hospitals, constant examinations and surprise inspections of the men; efforts of officers by means of warnings, lectures, &c.; improved discipline, moral tone and sobriety; diminution in the number of prostitutes, departure of diseased women, measures adopted to keep women away, encouragement of games and athletics, not allowing men to go to the bazaar, unless properly dressed (the trouble deters them); placing bazaars, brothels and liquor shops out of bounds; the emptying out of the bazaar in plague time; men being below par, and not inclined for venery; departure of women for the hills in summer, presence of an energetic cantonment magistrate, the provision of lotions and towels for the men in bazaars and barracks, hospital stoppages.

The following table shows the admission-rate for venereal disease as far back as the records for India as a whole permit. The heading "primary syphilis" includes the soft sore throughout:—

Year.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.	Year.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.
1872	61·2	22·4	179·0	1886	157·9	33·3	389·5
1873	53·4	20·4	166·7	1887	142·1	29·4	361·2
1874	68·3	25·2	192·7	1888	142·1	32·4	370·6
1875	67·1	25·1	205·1	1889	225·1	51·2	481·5
1876	59·8	23·9	189·9	1890	220·7	66·3	503·5
1877	65·2	22·1	208·5	1891	159·2	60·0	400·7
1878	95·3	22·0	271·3	1892	161·1	57·8	409·9
1879	79·2	24·5	234·8	1893	213·6	61·6	466·0
1880	87·9	23·1	249·7	1894	248·1	74·6	511·4
1881	92·0	23·1	260·5	1895	239·0	84·9	522·3
1882	87·6	23·2	265·2	1896	226·4	97·7	511·6
1883	87·2	23·5	270·3	1897	201·7	101·9	485·7
1884	90·2	24·4	293·9	1898	145·0	87·1	362·9
1885	122·1	28·7	342·7	1899	120·5	71·9	313·4

The decrease in the total ratio continued, and the ratio of 1899 was the lowest since 1884. The secondary syphilis ratio also fell again.

Invaliding.—In the whole army of India 2,142 men were invalided, or 31·64 per 1,000 of strength, against 2,580 and 38·09 in the preceding year, the decrease being greatly due to the smaller number of men invalided for ague. The ratio for the decennium 1889–98 was 27·50. The proportion of invalids to strength was lowest in the Punjab Command, and highest, as before, in the Madras Command. Thirty-one per cent. of the total number invalided were sent home as unfit for further service. The case of each soldier sent home is, however, reconsidered in England by a medical board; so that the Indian figures do not show the real final disposal of invalids.

—	1895.	1896.	1897.	1898.	1899.
India	33	39	34	28	31

Invaliding according to age and Indian service.—The percentage of men who were invalided while under 25 years of age to the whole number invalided was 59, against 62 in 1898. Of the total number of men invalided, 38 per cent. were of less than two years' service, and 81 per cent. were of less than five years' service.

Invaliding from venereal disease was most frequent between the ages of 20 and 30, and especially between 20 and 25; and, although it was most frequent in the second year of service, the frequency up to five years' service was all but uniform.

Officers.—The vital statistics of officers show that the death-rate for the British army was 8·81, and that for the Indian army 7·36, both, especially the former, much lower than in the preceding year. The number of deaths from enteric fever was less than in 1898 among both classes of officers. Enteric fever caused, as usual, more deaths among the British than among the Indian officers. Possible reasons for this difference were mentioned in last report. The constantly sick, admission and death-rates were lower than for men, but the invaliding-rate higher. The admission-rates from ague, tubercle of the lungs, and venereal diseases were lower than among the men; but the death-rates from enteric fever and hepatic abscess were higher. The chief causes of admission among officers were ague and simple continued fever; and, while the admission-rates from enteric fever and ague were lessened, the admission-rates from influenza, respiratory diseases and hepatic abscess were raised. Enteric fever was the chief cause of death, but the ratio was lower than in the previous year.

There were no cases of cholera. The greatest numbers of cases of enteric fever at individual stations were four each at Lucknow, Mhow and Poona. No special explanations are given as to the occurrence of the disease among officers. The medical officer at Quetta states that two of the young officers who had been once inoculated contracted the disease, both having been unduly exposed to the sun's rays and to great fatigue; but the attack was mild in both cases, and evidently modified by the inoculation. The following note from Solon illustrates the need for caution in the use of serum diagnosis:—

An officer had two admissions from remittent fever, having previously suffered severely from malaria. Two days after his second admission I sent a specimen of his blood to Mr. Hankin, who replied that it reacted strongly to the Widal test. In the meantime the patient's temperature had dropped to normal; so, at Mr. Hankin's request, I forwarded a second specimen. This did not react. Mr. Hankin explained that the hot weather had injured the serum, and that the second result was the correct one.

Women.—The health of the women was considerably better in 1899 than in 1898, and in the table all the ratios of 1899 are lower than those of the decennium:—

Period.	Average annual strength.	Admission-rate per 1,000.	Constantly-sick rate per 1,000.	Death-rate per 1,000.
1889–98	31,595	807·7	34·5	16·46
1898	3,118	772·9	37·9	16·04
1899	3,093	670·2	33·1	14·55

The chief causes of admission were debility, ague, and the diseases peculiar to women. Among the diseases which caused increased admission were small-pox, pneumonia, dysentery, puerperal affections, and the other diseases peculiar to women; while from enteric fever, simple continued fever, malarial fevers, influenza, and debility admission was lessened. Debility caused about 38 per cent. of the total sickness, and ague 17 per cent.

The chief causes of death were enteric fever and puerperal affections. Among the diseases which gave increased mortality were malarial fevers, respiratory diseases, and bowel-complaints; but mortality from enteric fever, small-pox, tubercle of the lungs, and puerperal affections was diminished. Enteric fever caused nearly 13 per cent. of the total deaths, and puerperal diseases over 13 per cent.

There were no cases of cholera; and Lucknow was the only station where more than two cases of enteric fever occurred. No special explanation of the origin of cases among women is given by medical officers.

Children.—That the health of the children was somewhat better than in 1898, and that only the constantly-sick ratio of 1899 was greater than the corresponding ratio of the decennium, may be seen from the following table:—

Period.	Average annual strength.	Admission-rate per 1,000	Constantly sick rate per 1,000.	Death-rate per 1,000.
1889–98	57,768	575·2	24·4	45·58
1898	5,592	606·6	28·8	41·13
1899	5,500	527·1	27·2	41·09

The chief causes of admission were ague, respiratory diseases, and measles. Among the diseases with raised admission-rates were small-pox, measles, influenza, and tubercle; while admission from cholera, whooping cough, enteric fever, malarial fevers, simple continued fever, respiratory diseases, bowel complaints, and affections of the eye was lessened. Ague caused 17 per cent. of the total sickness, respiratory diseases nearly 13 per cent., and measles over 11 per cent.

The chief causes of death were respiratory diseases, diarrhœa, debility (including immaturity at birth), teething and convulsions. Among the diseases from which there was increased mortality were respiratory diseases, debility, teething, ague and diphtheria. Mortality from remittent fever, simple continued fever, bowel complaints, tubercular diseases, convulsions, and enteric fever was lowered. Respiratory diseases caused 16 per cent. of the total deaths, diarrhœa 13 per cent., debility 12 per cent., teething 10 per cent., and convulsions 9 per cent.

There was no cholera. Campbellpur, Nasirabad and Kirkee were the only stations which registered more than two cases of enteric fever—three each. Thirteen cases of scarlatina were reported: four at Quetta, two at Kasauli, two at Bangalore, and one at each of 10 other stations. All that is known as to the origin of the disease has been mentioned in page 57. Rawalpindi, Kamptee, Mhow and Ranikhet had the largest numbers of cases of measles. At Ranikhet the disease is stated to have been imported from Bareilly, at Jhansi and Mooltan to have been contracted from the children of the railway employés, and at Cherat and Kamptee to have been derived from natives.

Native Troops.

Sickness and mortality in 1899 :—The health of the Native troops was better than in the preceding year, as shown in the following table :—

Year.	Average strength.	Ratio per 1,000. Admissions into hospital.	Constantly sick.	Deaths from Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.	Mortality, including absent deaths.
1889–98 ...	128,106	917	33	1·00	1·31	3·19	·68	12·70	17·40
1898	126,036	816	33	·33	1·08	3·77	·49	11·07	13·33
1899	128,529	705	28	·53	1·17	3·86	·37	10·70	14·50

The chief cause of admission was ague. Among the diseases with raised admission-rates were influenza, cholera, and small-pox. Among those with lessened rates were enteric fever, malarial fevers, simple continued fever, tubercle of the lungs, respiratory diseases, bowel complaints, scurvy, and venercal diseases. Ague caused 37 per cent. of the total admissions.

The chief causes of death were pneumonia and remittent fever. Among the diseases which caused increased mortality were small-pox, cholera, malarial and simple continued fevers, circulatory diseases, tubercle of the lungs, respiratory diseases, and debility. Among those from which mortality was lessened were enteric fever, bowel complaints, and hepatic abscess. Pneumonia caused 36 per cent. of the total deaths, and remittent fever 11 per cent.

The total number invalided for discharge was 1,618, and the chief causes of invaliding were debility, rheumatism, and venereal diseases.

If the following table be compared with that on page 41 it will be seen that the Native soldier suffered less from enteric fever, simple continued fever, diarrhœa, hepatitic affections, and venereal diseases ; and more from influenza, cholera, small-pox, ague, remittent fever, tubercle of the lungs, respiratory diseases, especially pneumonia, and dysentery, than his European comrade. He also suffered more from scurvy. These relations are usual, except with regard to tubercle of the lungs.

Ratios of Commands.

	Ratio per 1,000 of the Average Strength. Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.
I.—Average Annual Strength	26,820	44,224	23,255	26,657	6,556	128,529
II.—Constantly-Sick-rate of the Year... ...	29·2	27·4	29·8	26·3	14·9	27·7
III.—Admission-rate of the Year :						
Influenza	2·5	29·9	3·9	1·1	9·5	12·3
Cholera	2·1	1·1	·7	·2	—	1·0
Small-pox	·4	·6	·2	·2	—	·4
Enteric fever	·1	·2	—	·1	—	·1
Intermittent fever	307·5	256·6	239·6	220·7	164·3	260·2
Remittent fever	15·4	28·3	6·3	9·5	15·6	17·0
Simple continued fever	3·1	1·2	8·5	5·7	3·2	4·0
Tubercle of the lungs	4·1	4·4	2·2	2·6	·6	3·3
Pneumonia	13·9	23·5	5·6	19·4	9·9	16·6
Other respiratory diseases	22·4	31·5	23·0	30·8	14·5	27·0
Dysentery	37·2	39·5	25·2	44·5	16·2	38·0
Diarrhœa	5·9	6·6	5·0	12·7	2·0	7·1
Hepatic abscess	—	—	·2	—	·2	·1
„ congestion and inflammation ...	1·2	·6	1·6	2·1	·8	1·2
Scurvy	1·0	2·5	·1	5·4	3·2	2·4
Venereal diseases	38·7	21·5	51·9	37·7	21·5	34·1
All Causes	715·7	730·9	672·3	698·8	430·1	704·8

Ratios of Commands—continued.

	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
IV.—Death-rate of the Year:						
Cholera	1·19	·50	·52	·08	—	·53
Small-pox	—	·02	—	·04	—	·02
Enteric fever	—	·02	—	·08	—	·02
Intermittent fever	1·01	·63	·90	·34	·15	·68
Remittent fever	·89	1·67	·82	·90	·92	1·17
Simple continued fever	—	·05	—	·11	—	·04
Circulatory diseases	·22	·11	·52	·26	·15	·24
Tubercle of the lungs	·89	·93	·30	·53	·15	·68
Pneumonia	2·39	5·83	1·46	4·31	3·51	3·86
Other respiratory diseases	·26	·34	·39	·49	·15	·37
Dysentery	·67	·20	·17	·41	·15	·35
Diarrhœa	·22	—	·13	·26	—	·12
Hepatic abscess	·11	·02	·04	—	—	·04
Anæmia and debility	·19	·14	·30	·15	—	·17
All Causes	10·03	12·48	9·03	10·69	6·86	10·70

* For complete detail of diseases *see* Table

Commands.—Of the commands the Punjab was the most unhealthy, but it was more healthy than in the previous year. The highest ratios of mortality from cholera, ague, and dysentery were in Bengal; the highest from remittent fever, tubercle of the lungs, and pneumonia in the Punjab; the highest from small-pox, enteric fever, and respiratory diseases other than pneumonia, in Bombay; and the highest from debility in Madras.

Field Forces.—The small Mishmi Field Force was the only body of men on active service in 1899.

Geographical Groups.—The table which follows shows that for the decennium the highest constantly-sick-ratios were those of Assam, Burma Inland, and then those of Bengal-Orissa and the Hills; and the lowest those of Western Coast, Central India, Deccan, and Southern India. The highest mortalities for the decennium from cholera and from respiratory diseases were respectively in Assam and in the Indus Valley.

		Ratio per 1,000 of Strength.											
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
		Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	N. W. Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	India.
1889–1898.	Constantly-sick-rate...	38·7	53·1	59·8	45·4	28·4	30·9	38·6	27·4	27·7	26·6	27·8	42·2	33·1
	Death-rates from—													
	Cholera	·05	1·03	2·77	·38	·92	·59	·50	·66	·85	·06	1·59	1·06	1·00
	Respiratory diseases	1·30	2·08	2·59	1·31	1·88	4·70	9·30	2·80	1·99	1·00	1·72	5·23	3·90
1898.	Constantly-sick-rate...	25·9	35·7	40·3	39·9	33·5	32·4	39·0	26·3	27·1	36·3	33·4	44·5	32·9
	Death-rates from—													
	Cholera	—	—	8·40	·34	·18	·22	—	—	—	—	1·77	·11	·33
	Respiratory diseases	·72	·92	3·23	1·37	1·78	5·06	9·62	2·83	2·01	1·44	2·15	5·65	4·13
1899.	Constantly-sick-rate...	36·2	38·2	42·7	42·2	26·3	24·4	31·5	22·1	22·3	30·0	32·7	38·9	27·7
	Death-rates from—													
	Cholera	—	—	—	—	—	1·09	—	—	·10	—	·99	·05	·53
	Respiratory diseases	—	·94	—	1·74	2·60	3·54	8·97	2·80	3·14	3·02	1·86	7·42	4·23

In the following table it may be seen that Burma Coast had the highest admission ratios from simple continued fever and venereal diseases, and the lowest from respiratory disease other than pneumonia; Burma Inland the lowest from pneumonia; Assam the highest from influenza, respiratory diseases other than pneumonia, dysentery, congestion of the liver, and scurvy; Bengal-Orissa the highest from ague; Upper Sub-Himalaya the highest from cholera; Indus Valley the highest from small-pox, remittent fever, and pneumonia; Western Coast the highest from diarrhœa, and the lowest from ague: Southern India the highest from abscess of the liver and the lowest from dysentery; and the Hill Stations the highest from tubercle of the lungs. The highest constantly-sick-rate was in Assam, the highest admission rate in Bengal-Orissa, and the highest death-rate in the Hill Stations.

Ratios of Geographical Groups.

—	Ratio per 1,000 of the Average Strength.												
	I. Burma Coast and Bay Islands.	II. Burma Inland.	III. Assam.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India, and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII. Hill Stations.	Army of India.*
I.—Average Annual Strength	1,389	4,257	1,490	2,867	6,166	15,555	16,269	12,522	19,410	3,306	8,075	18,339	128,529
II.—Constantly-sick-Rate of the Year.	36·2	38·2	42·7	42·2	26·3	24·4	31·5	22·1	22·3	30·0	32·7	38·9	27·7
III.—Admission-Rate of the Year:													
Influenza	—	2·6	28·9	—	·2	·7	17·6	·3	9·5	·6	—	20·2	12·3
Cholera	—	—	—	—	—	2·5	·1	—	·1	—	1·7	·1	1·0
Small-pox	—	·2	—	·7	·5	·2	1·4	·3	·1	—	·4	·1	·4
Enteric fever	—	—	—	—	—	·3	·3	—	·1	·3	·1	·3	·1
Intermittent fever	262·1	487·0	291·9	1,077·8	159·3	162·2	278·3	202·0	228·0	154·9	189·2	322·5	260·2
Remittent fever	16·6	10·1	20·1	12·2	17·0	22·8	32·8	10·2	11·2	14·5	3·6	22·9	17·0
Simple continued fever	20·9	2·3	1·3	·3	9·2	·8	2·5	5·7	4·1	7·3	15·4	·9	4·0
Tubercle of the lungs	2·9	2·6	6·7	1·4	3·6	5·5	3·8	2·4	1·0	3·3	2·1	7·1	3·3
Pneumonia	5·0	2·8	8·7	3·1	12·5	15·1	32·3	15·4	12·1	13·0	6·7	26·6	16·6
Other respiratory diseases	15·8	49·3	59·4	24·1	18·8	19·0	42·5	19·1	16·0	36·0	19·3	41·3	27·0
Dysentery	85·0	33·4	93·3	55·5	30·7	22·1	45·9	23·6	27·2	77·7	16·6	47·1	38·0
Diarrhœa	·7	12·5	8·1	12·2	5·5	3 8	7·0	8·9	4·5	29·6	2·2	8·3	7·1
Hepatic abscess	—	·2	—	—	·2	—	—	—	·1	—	·4	·1	·1
„ congestion and inflammation.	—	1·6	2·7	·7	·8	·5	·7	1·3	1·2	1·2	2·4	2·5	1·2
Scurvy	—	—	5·4	·3	·5	1·2	2·3	2·9	2·0	2·1	·1	5·0	2·4
Venereal diseases	71·3	40·4	45·6	42·2	28·7	31·8	17·3	31·9	42·7	59·0	47·7	47·2	34·1
All Causes	887·0	994·8	963·8	1,480·6	544·8	553·8	838·8	583·4	618·3	754·7	597·2	879·5	704·8
IV.—Death-Rate of the Year:													
Cholera	—	—	—	—	—	1·09	—	—	·10	—	·99	·05	·53
Small-pox	—	—	—	—	—	—	·06	·08	—	—	—	—	·02
Enteric fever	—	—	—	—	—	—	—	—	—	·30	—	·11	·02
Intermittent fever	·72	2·35	·67	2·44	·81	·84	·37	—	·31	·60	·37	·98	·68
Remittent fever	·72	·70	·67	1·05	·65	1·41	2·15	1·04	·57	1·81	1·11	1·36	1·17
Simple continued fever	—	—	—	—	—	—	·06	—	·10	·30	—	·05	·04
Circulatory diseases	—	·47	—	·35	—	·26	·06	·16	·36	·30	·51	·33	·24
Tubercle of the lungs	—	·47	—	—	·32	·90	·61	·48	·21	—	·37	2·29	·68
Pneumonia	—	·70	—	1·05	2·11	3·28	8·42	2·40	2·88	3·02	1·49	6·76	3·86
Other respiratory diseases	—	·23	—	·70	·49	·26	·55	·40	·26	—	·37	·65	·37
Dysentery	·72	—	·67	1·74	—	·45	·12	·40	·10	1·21	·25	·27	·35
Diarrhœa	—	·47	—	—	·32	·06	—	—	·10	·30	—	·27	·12
Hepatic abscess	—	—	—	·35	·16	—	—	—	—	—	·12	·11	·04
Anæmia and debility	—	·47	·67	·35	·16	·12	·06	·08	·21	—	·12	·22	·17
All Causes	7·20	9·40	6·71	9·77	7·78	9·90	15·31	6·71	9·43	9·98	7·55	15·54	10·70

* Including Group Extra-India.

Stations.—Of the large stations throughout India with a strength of not less than 1,000, the following returned the highest death-rates:—Edwardesabad 28·04, Belgam 22·85, Peshawar 18·55, Mardan 17·87, and Dera Ismail Khan 17·21. Edwardesabad was in the list also in 1898, but its statistics have improved since then. The principal cause of death at all those stations was pneumonia.

Regiments.—The most unhealthy corps were the 4th Field Battery, Hyderabad Contingent, the 42nd Gurkha Rifles, the 5th Bengal Infantry, the 5th Bombay Cavalry, the 5th Punjab Infantry, and the 17th Bombay Infantry.

Principal Diseases: Influenza.—Attention having been directed to the health statistics of India, of the commands, of the geographical groups, of stations, and of regiments, it will be convenient now to consider some of the chief diseases. Influenza increased considerably, this being the first year to break the regular alternation shown in the table. The geographical groups affected both in 1898 and 1899 were II, V, VI, VII, VIII, IX, XII; III and X were newly affected in 1899; I, IV, and XI were attacked in 1898, but not in 1899. In proportion to strength the Assam group was most severely affected, and next to it the Hill Stations and the Indus Valley. The following shows its monthly progress since its beginning in 1890. The maximum month varied from year to year, but over the period as a whole most cases occurred in April and March, and fewest in October and September:—

Years.	Number of Admissions into Hospital in each Month.												Total.	Admitted per 1,000 of Strength.	Died per 1,000 of Strength.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.			
1890 ...	1	8	2,460	5,118	492	82	55	—	—	—	1	—	8,217	64·3	·41
1891 ...	—	—	1	—	105	259	123	106	51	22	17	215	899	7·0	·09
1892 ...	681	371	511	149	40	5	5	7	—	1	7	18	1,795	14·1	·15
1893 ...	8	28	65	99	95	13	9	7	—	3	53	404	784	6·2	·20
1894 ...	159	203	232	384	143	11	5	—	1	1	5	11	1,155	9·0	·16
1895 ...	26	28	53	76	110	25	60	57	19	17	31	408	910	7·0	·08
1896 ...	372	196	397	35	22	11	33	57	53	39	82	72	1,369	10·7	·30
1897 ...	97	61	100	117	84	79	22	—	42	67	23	3	695	5·4	·04
1898 ...	110	290	280	96	180	24	1	—	1	10	32	23	1,047	8·3	·03
1899 ...	7	145	149	65	655	210	256	61	6	5	18	9	1,586	12·3	·16
Total	1,461	1,330	4,248	6,139	1,926	719	569	295	173	165	269	1,163	18,457	14·4	·16

The greatest number of cases occurred in the Khyber Force, and at Peshawar, Wana, and Bakloh. In the Khyber and at Wana the disease was confined to two adjoining months of the year, at Peshawar to three; but at Bakloh it spread over four. In the Khyber Force the disease was mild, and had some resemblance to dengue. The following table shows that in 1899 the Native troops had, as usual, a higher ratio than the European troops, but a lower ratio than the prisoners:—

Years.	Per 1,000 of Average Strength.											
	Influenza.						Pneumonia.					
	European Troops.		Native Troops.		Prisoners.		European Troops.		Native Troops.		Prisoners.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1890	33·4	·03	64·3	·41	78·6	·67	4·6	·90	16·7	3·96	18·5	5·71
1891	5·5	·04	7·0	·09	19·0	·29	2·6	·54	11·6	2·53	17·0	4·87
1892	12·7	·01	14·1	·15	56·7	1·26	3·5	·62	13·6	3·26	18·4	5·56
1893	·3	—	6·2	·20	6·4	·09	3·4	·70	12·3	2·75	15·9	3·95
1894	3·4	·01	9·0	·16	41·0	·43	3·7	·75	12·9	2·87	15·4	4·31
1895	7·8	·03	7·0	·08	20·3	·15	4·4	·51	17·5	4·20	16·4	4·00
1896	11·5	·11	10·7	·30	37·6	·60	5·2	·64	15·3	3·14	19·1	4·34
1897	4·0	·01	5·4	·04	8·4	·21	3·4	·60	13·0	2·73	15·6	4·24
1898	8·3	·01	8·3	·03	21·0	·33	3·3	·61	16·5	3·77	15·8	3·94
1899	10·0	·01	12·3	·10	14·7	·18	5·1	·66	16·6	3·86	14·4	3·34

It shows also the relations of the pneumonia death-rate year by year to the admission rate from influenza, though, of course, the presence or absence of influenza is not the only circumstance which influences the pneumonia death-rate. The cases were mostly described as having been of a mild type, but 13 deaths were returned as against four in the preceding year. There were, however, not more than three deaths at any one station.

The 37th Dogras, the 5th Punjab Infantry, and the 2nd Battalion of the 4th Gurkha Rifles were the regiments which suffered most.

Cholera.—There were 126 cases of cholera with 68 deaths, against 48 with 42 in the preceding year. The admission rate was 1·0 against 0·3, and the death-rate 0·53 against 0·33. The only months quite free from the disease were May and December; but the maximum quarter was August–October, and the maximum month August. The 42nd Gurkha Rifles and the 17th Bengal Cavalry suffered the most severely, and after them the 40th Pathans and the 4th Madras Infantry. The second and third of these were quartered at Meean Meer, and it is said that the infantry was probably infected by the cavalry through the medium of water. With the Gurkhas the disease broke out on board a steamer on the voyage from Gauhati. The disease was prevalent at Trichinopoly at the time the 4th Madras Infantry became affected.

Small-pox.—There were 46 cases of small-pox with 2 deaths, against 26 with 1 in the preceding year. The admission rate was 0·4 per 1,000 against 0·2, and the death-rate 0·02 against 0·01. In the Frontier and Indus Valley group the cases (23) bore the highest proportion to strength. Peshawar had 15 cases, and 10 of them occurred in the 37th Dogras. The medical officer of the regiment says :—

> The disease has been prevalent in all parts of Peshawar during the last six months of the year. In no case did two cases occur in the same company except after a long interval, and in no case could any connexion be traced between any case and any other case which had occurred previously in the regiment. The source of infection appeared to be always outside the regiment. The one exception was a man who was badly marked with small-pox, and was selected to act as sick attendant in the small-pox hospital. He contracted the disease a second time. One hundred and sixteen men were vaccinated during the year, but in almost all cases they had good marks of previous vaccination. Very few recruits have no marks of either small-pox or vaccination on enlistment.

Ague, Remittent Fever, Simple Continued Fever.—To ague was due nearly 37 per cent. of the sickness of the Native army. To the fact that the year over a great part of India was a dry one is probably due the reduction of the admission ratio from 335 to 260. Bengal-Orissa was by far the most malarious group, and in that part of India the monsoon rainfall was in excess. The most malarious month was October, and the least malarious April. The 12th and 4th Bengal Infantry were quartered at Calcutta in the Bengal-Orissa group, and it is stated that some of the villages in that part of the country were being deserted on account of malaria. The 1st Bengal Infantry, which next to the 12th suffered most, was in the Mauritius, where the *anopheles* was found.

Remittent fever caused 11 per cent. of the total deaths, and prevailed most in August and least in February. The admission rate fell from 20 to 17 per 1,000, but the death-rate rose from 1·08 to 1·17. The 36th Sikhs, the 27th Punjab Infantry, and the 1st Punjab Infantry had the greatest number of cases. The prophylactic issue of quinine appears to be a measure frequently employed, but in 1899, as in former years, opinions as to the results varied. It is important to begin the issue early enough.

The proportion of cases returned as simple continued fever is much lower in the Native army than in the European; perhaps because the Native soldier is not liable to enteric fever, even in a mild form, because he is not so easily affected by the heat, because his ingestion-habits are more regular, and because the tendency in the Native army is to call mild fevers ague. The highest numbers of cases were returned by the 28th Madras Infantry and the 16th Bengal Infantry. The admission-ratio fell in 1899.

Enteric Fever.—The ratio of admission from enteric fever in the Native army in 1899 was 0·1 per 1,000 of strength, and the death-rate 0·02, against 0·3 and 0·13 in the previous year. The corresponding ratios for the 22-year period 1877–98 are 0·2 and 0·09. The following table shows that the ratios for European troops are very unlike those for Native troops and prisoners :—

—	1877–87.		1888–98.		1877–98.		1899.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
European troops	9·3	3·21	23·6	6·29	17·0	4·88	20·6	5·14
Native troops ...	·2	.11	·2	·08	·2	·09	·1	·02
Jail population	·2	·10	·3	·11	·2	·10	·2	·11

Again the death ratio for ague, remittent fever, simple continued fever, and enteric fever, combined, for European troops was 5·59, for Native troops only 1·91, or as 3·1; which shows that the paucity of enteric fever in the returns of the Native army is not due to its being registered under some other fever-heading. In other words, it is quite certain that in 1899, as in former years, Native soldiers and prisoners were much less liable to enteric fever than European soldiers.

In the whole Native army of India only 18 cases with 3 deaths were returned as enteric fever, as against 40 cases with 17 deaths in 1898. Only three stations had so many as 3 cases—Dehra Dun, Edwardesabad, and Kila Drosh. The 1st Battalion, 2nd Gurkha Rifles, and the 1st Punjab Infantry returned 3 cases each, the 2nd Sikhs 2 cases, and 7 other regiments 1 case each.

Plague.—In 1899 there were 76 cases of plague with 45 deaths, against 94 with 58 in 1898, and 131 with 82 in 1897.

Respiratory Diseases.—Morbidity from respiratory diseases was reduced, but mortality increased :—

Period.	Ratio per 1,000 of Strength.			
	Respiratory Diseases.		Pneumonia.	
	Admissions.	Deaths.	Admissions.	Deaths.
1889–98...	49	3·90	14	3·19
1898	45	4·13	16	3·77
1899	44	4·23	17	3·86

Respiratory diseases are the chief cause of death in the Native army, and in 1899 nearly 40 per cent. of all deaths were due to them. For respiratory diseases other than pneumonia the admission ratios were those of Assam, Burma Inland, Indus Valley, and the Hills. Non-pneumonic respiratory diseases were most frequent in the 30th Bombay Infantry and in the Queen's Own Corps of Guides. The medical officer of the latter considers that a prominent factor in the causation of pneumonia, bronchitis, and other respiratory diseases at Mardan is the amount of irrigation that goes on both within, and in the vicinity of, cantonments, by which the humidity of the air, contrasts of temperature between day and night, and liability to chills are increased.

Pneumonia.—The admission and death rates from pneumonia, as may be seen from the table given in the preceding paragraph, rose somewhat, and were above the decennial ratios. In the second table on page 65 is displayed the relation from year to year between pneumonia and influenza. In 1899 pneumonia caused 36 per cent. of the total mortality.

Dysentery, Diarrhœa.—The admission and death ratios from dysentery and from diarrhœa in 1899 were low :—

Period.	Ratio per 1,000 of Strength.			
	Dysentery.		Diarrhœa.	
	Admissions.	Deaths.	Admissions.	Deaths.
1889–98...	50·9	·69	16·4	·37
1898	44·0	·49	9·4	·20
1899	38·0	·35	7·1	·12

The highest admission ratios for dysentery were in the Bombay Command and the Assam Group, as against the Punjab Command and the Assam Group in the two years

preceding. The highest mortality was in the Bengal Command and the Bengal-Orissa Group. After Assam, dysentery was most prevalent in Burma Coast, Western Coast, and Bengal-Orissa; and it was least prevalent in Southern India. The disease was much more common in the second half of the year than in the first, the maximum month being August and the minimum February.

Venereal Diseases.—The following table is given to compare with the corresponding one for European troops on page 59 :—

Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.	Years.	Primary Syphilis.	Secondary Syphilis.	Total Venereal Diseases.
1877	11·5	5·3	26·7	1889	16·6	6·4	38·9
1878	16·3	5·8	37·5	1890	16·0	6·9	41·1
1879	16·5	7·0	37·1	1891	13·6	6·9	37·9
1880	15·0	5·8	33·3	1892	14·1	7·9	39·6
1881	17·9	7·2	39·5	1893	13·3	9·0	36·4
1882	14·7	5·9	34·4	1894	13·8	8·2	32·3
1883	13·0	6·5	31·6	1895	13·1	7·3	31·3
1884	11·0	5·3	27·9	1896	15·5	8·9	37·2
1885	11·2	5·9	30·1	1897	16·1	9·0	40·8
1886	13·7	6·0	28·1	1898	14·3	11·5	40·0
1887	12·6	6·1	27·4	1899	11·3	9·9	34·1
1888	13·5	5·4	31·5				

The figures for India are not available for the years before 1877. Primary syphilis includes the local sore throughout. All the venereal ratios of Native troops run at a much lower level than those of European troops, and they have remained comparatively steady during the years of which the statistics are given.

Leaving the Hyderabad Contingent out of account, the lowest ratios for both European and Native troops were, as in 1898, those of the Punjab Command; while for both European and Native troops the Madras Command had the highest ratio. In all the commands the ratios of Native troops were much lower than those of European troops.

Whilst among the European troops an average strength of 67,697 gave 21,217 admissions, in the case of Native troops an average strength of 128,529 gave only 4,378 admissions. In other words, there were only 34 admissions for every 1,000 men among Native troops, against 313 for every 1,000 among European troops.

The admission rate was 5·9 per 1,000 of strength less than in 1898. There were 12 deaths and 133 invalidings *directly* due to venereal disease. In 20 stations out of 199 (against 36 out of 198) the admission rate from secondary syphilis was over 20 per 1,000 of strength and in 45 (against 44) it was over 10 per 1,000 of strength.

For India the ratio of primary syphilis *plus* soft chancre fell by 3·0 per 1,000 of strength, that of secondary syphilis by 1·6, and that of gonorrhœa by 1·3; the net result being a fall of 5·9 for all forms of venereal disease taken together, as noticed above. In 1898 the Madras Command had the highest ratio for each form of venereal disease.

Beri-beri, Strongylus Duodenalis.—All the 202 cases of beri-beri occurred in Madras regiments, especially the 2nd and 7th Infantry. The medical officer of the latter submits a report, but admits that he has not been able to throw any new light upon the etiology of the disease. The men affected in the 11th Madras Infantry were chiefly natives of the endemic area. The increased prevalence of beri-beri in the 2nd Madras Infantry is explained as due to the men having become saturated with the poison from further residence in Vizianagram. The disease prevails in the moist months of August and September, but a heavy fall of rain almost completely stops it. About a fourth of the men of the regiment have had their health undermined by their less than two years' stay

in Vizianagram. There was little mortality, and most men were eventually able to return to duty; but some of the paralytic and other symptoms were decided.

The intimate cause of beri-beri has not yet been discovered, or at least no agreement has been reached on the point; and in the meantime it is not possible to feel sure how much of the beri-beri of the Native army returns is really beri-beri and how much is malaria. So far as they have gone, the researches of Fearnside have had the effect of transferring cases from the head of beri-beri to that of malaria.

No cases of sickness or death caused by the *Strongylus duodenalis* (*Dochmius*, *Ancylostomum*) were reported.

Jails.

Sickness and Mortality in 1899.—The health of the prisoners in the jails of India was better even than in the previous year, and showed a marked improvement over that of 1897 and of the quinquennium.

Year.	Average Strength.	Ratio per 1,000.									
		Admissions into Hospital.	Constantly Sick.	Deaths from							
				Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Tubercle of the Lungs.	Anæmia and Debility.	All Causes.
1894–98*	127,569	886	36	1·47	·95	6·37	2·01	4·50	2·52	1·62	26·17
1898* ...	111,344	976	39	·13	·95	5·72	1·48	4·88	3·25	2·01	25·87
1899* ...	110,016	918	35	·56	·82	5·47	1·31	4·30	3·55	·95	23·87

The following provinces showed the lowest death-rates:—Berar and Secunderabad, Madras, the Punjab, Burma, the North-Western Provinces and Oudh, and Bengal. The provinces which were above the all-India average are the Central Provinces, Bombay, the Andamans, and Assam. The diseases which caused the greatest number of admissions to hospital were malarial fevers, dysentery, abscesses and boils, and diarrhœa; but those causing the greatest number of deaths were dysentery, tubercle of the lungs, diarrhœa, pneumonia, and other respiratory diseases. Dysentery caused nearly 23 per cent. of the total deaths, tubercle of the lungs nearly 15 per cent., and pneumonia 14 per cent.

Administrations.—The following table contrasts the health of the different jail administrations:—

—	Year.	Average Strength.	Ratio per 1,000.*									
			Admissions.	Constantly Sick.	Deaths from							
					Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Tubercle of the Lungs	Anæmia and Debility.	All Causes.
Andamans	1894–98	10,536	1,507	50	—	3·44	7·63	2·52	2·54	3·76	2·47	27·85
	1898	10,890	1,405	48	—	2·57	9·18	1·50	2·20	5·69	·83	27·09
	1899	11,293	1,937	57	—	3·19	15·58	2·75	3·90	7·62	2·92	42·24
Burma	1894–98	13,376	749	35	2·20	·69	4·31	1·17	2·66	3·51	·40	21·80
	1898	12,674	619	31	·47	·55	4·73	·71	3·47	4·18	·39	20·59
	1899	12,548	584	26	1·99	·08	4·62	·40	1·91	3·27	·56	18·73

* Excluding subsidiary jails.

—	Year.	Average Strength.	Ratio per 1,000.*									
					Deaths from							
			Admissions.	Constantly Sick.	Cholera.	Remittent Fever.	Dysentery.	Diarrhœa.	Respiratory Diseases.	Tubercle of the Lungs.	Anæmia and Debility.	All Causes.
Assam	1894–98	1,249	1,142	57	2·08	1·60	12·49	7·85	4·00	1·44	5·44	52·68
	1898	1,276	1,018	55	1·57	3·13	8·62	4·70	3·13	—	6·27	37·62
	1899	1,323	962	48	13·61	4·54	6·05	4·54	6·04	1·51	1·51	55·18
Bengal	1894–98	17,102	1,111	39	2·64	1·16	9·45	1·87	4·30	3·53	1·24	32·06
	1898	18,007	1,004	35	·17	·94	5·11	1·11	4·94	2·78	·67	22·77
	1899	18,118	1,004	35	·28	·66	6·18	·99	3·97	4·42	·77	23·79
N.-W. P. and Oudh.	1894–98	31,857	923	50	1·04	·51	7·01	2·50	6·35	2·44	3·20	30·86
	1898	31,535	930	47	·03	·35	6·28	1·74	5·71	3·08	4·82	29·14
	1899	29,303	792	38	·10	·41	5·36	1·43	5·40	2·90	·65	22·25
Punjab	1894–98	11,991	1,422	35	—	·80	2·70	·97	6·30	2·15	·32	19·16
	1898	12,554	1,369	37	—	1·04	4·06	1·59	6·61	2·23	·24	23·50
	1899	13,512	1,097	33	—	·44	2·52	·96	5·99	2·96	·15	18·72
Bombay	1894–98	7,558	864	31	2·17	1·93	3·15	3·28	9·13	2·51	1·22	31·44
	1898	8,461	760	29	—	2·25	1·54	2·01	5·67	1·77	1·54	22·46
	1899	8,981	614	28	·89	1·22	2·45	1·78	5·46	2·67	·89	24·72
Berar and Secunderabad.	1894–98	1,547	762	24	·39	·65	2·97	·91	7·24	1·29	3·10	25·60
	1898	1,612	581	17	—	·62	·62	—	4·34	1·24	3·10	14·89
	1899	1,426	445	13	—	·70	1·40	·70	2·10	1·40	2·10	13·32
Central Provinces.	1894–98	5,498	1,089	47	2·55	1·20	31·39	9·46	7·53	3·86	4·44	72·68
	1898	5,054	1,142	52	—	·59	11·67	3·36	4·16	3·56	3·17	34·63
	1899	4,148	850	28	·24	·48	4·10	1·69	3·37	2·17	1·69	24·59
Madras	1894–98	8,457	743	29	5·46	·35	4·78	·28	3·38	3·19	·40	28·40
	1898	8,844	715	30	·23	—	5·88	—	4·52	4·18	·11	28·38
	1899	8,806	502	22	·23	—	1·59	—	1·82	2·50	·68	16·13

* Excluding subsidiary jails.

It will be seen that although taking India as a whole the prisoners were healthier than in the previous year, yet this result is due to the marked improvement in certain provinces only, *e.g.*, Madras, the Central Provinces, and the North-Western Provinces. On the other hand, there was a marked falling off in health in the Andamans and Assam. In the Andamans the increased mortality is seen under every heading in the above table, and especially from dysentery and tubercle of the lungs. In Assam much of the mortality increase was due to the sharp outbreak of cholera in Gauhati Jail in October, 17 deaths in 25 cases. The year 1899 was, however, a good year for cholera. In every instance, except Assam, the mortality was much less than the quinquennial average, though it was not so free from cholera as 1898. The Andamans, as usual, the Berar-Secunderabad administration, and the Punjab, were free from cholera. Indeed, for the past seven years the jails of the Punjab have been cholera-free.

The death-rates returned under the heading " remittent fever " may, speaking generally, be taken as an index of the severity of the type of malarial fever ; and there is an increase under this heading in the Andamans, Assam, Berar, and the North-Western Provinces and Oudh. All others show a decrease. How much this is due to the influence of modern views about the malarial fevers it is difficult to say. Dysentery shows the highest ratio for mortality in the Andamans, Bengal, Assam, and the North-Western Provinces ; but in the Central Provinces, Assam, and Bengal it is much less than the quinquennial average. The ratio from respiratory diseases is highest in Assam. In most of the other provinces it is distinctly less than the decennial average. Tubercle of the

lungs shows a marked increase in the Andamans, Assam, and Bengal, while it is less in Burma, the North-Western Provinces, the Central Provinces, and Madras.

Anæmia and debility is not a satisfactory diagnosis, and there is a falling off in the cases returned under this vague heading in Assam, the North-Western Provinces, the Punjab, Bombay, Berar, and the Central Provinces.

Andamans.—Last year the Senior Medical Officer commented upon the scanty vegetable supply of these islands. In 1899 he reports a great improvement in the supply. *Roselle* has been widely planted, and proved much more acceptable to north of India convicts than the tamarind formerly issued. Mangoes and limes have been extensively planted. Boiled water is used by all labouring convicts. In the dry weather several tanks dried up, and were thoroughly cleaned out. There was a great increase in the amount of malarial fever, dysentery, and anæmia cases. There was much increase in the deaths from dysentery, respiratory affections, and tubercle of the lungs. The type of malarial fevers was mild. The dysentery deaths occurred to a large extent among old and feeble chronic cases. The Senior Medical Officer attributed the almost total disappearance of scurvy to the great improvement in the vegetable diet.

Burma.—There was a slight falling off in the average annual strength, and there was but little overcrowding except for short periods. It is noted that the regulation diet was not sufficient to prevent loss of weight in men employed on the severer forms of hard labour, and extra food was issued in several instances in the form of rice (4 oz.) or *dal* (2 oz.). As noted by the Inspector-General last year, the water of Pakokku Jail and of Magwe Jail contained 70 and 100 grains of solids per gallon, yet the health is exceptionally good. The system of direct trenching of night soil was found satisfactory. Sixteen per cent. of prisoners confessed to being habitual opium smokers before admission. The Superintendent of Bhamo Jail urges that confinement in jail and deprivation of opium may have a strong predisposing effect in rendering the prisoners more liable to dysentery. The site of Moulmein Jail is radically bad, low-lying, and water-logged. The chief mortality in this jail was from tuberculosis and dysentery. The latter disease was of a bad type, and especially attacked Karens and other hill tribes.

Assam.—The average annual strength was the highest for the quinquennium. The high mortality was due to the cholera outbreak at Gauhati; apart from cholera, it was practically the same as in the previous year, in which there was only one death from cholera. In three jails there were no deaths. The Chief Commissioner comments strongly upon the terrible mortality which prevails in the jails of Assam, and attributes it to the exposure involved in extramural labour, which is very largely in vogue for prisoners in these jails. This point is now being put to the test in Assam. Another important point, however, is the frequent absences of the superintendents of the jails on sanitary and inspection tours, which are part of their duties as civil surgeons of the districts. When the medical superintendent of a jail is absent on a tour for 82 or 121 days, it is absolutely certain that he cannot exercise that close and unremitting attention to the health of prisoners that is necessary, if death-rates and sickness are to be kept at a low figure. Assam is notoriously malarious, and the death-rate for malarial fevers is highest in Assam jails (11·34). The dysentery death-rate is also high. While Assam has the highest death-rate in India, the admission rate is only fourth on the list. Where the general health of the prisoners is bad, it is generally wise to make free use of the hospital; by admitting patients early and keeping them in hospital till they are thoroughly cured many lives will be saved.

Bengal.—The year 1899 was a healthy one in Bengal, the death-rate being 23·79, or a trifle beyond that of 1898, which was the lowest on record for Bengal, the average for the past quinquennium being 32·06 per 1,000. Cholera and small-pox were practically unknown during the year, and the admission rate for malarial fevers was moderate. The dysentery admission rate remained high, but the cases were generally of a mild type. Influenza caused a small number of admissions. There was but little overcrowding, except in Mymensingh Jail. The accommodation for under-trial prisoners is very limited in several jails. The scheme for boiling and filtering water in Buxar was completed, and and the Pasteur filters worked on the whole well in the five jails supplied with them, though it is not clear that their use has in any way diminished the incidence of diseases generally considered to be water-borne. At Mymensingh dried plantain flour was used with success in the dietetic treatment of bowel-complaints. Buxar Central Prison suffered most from malarial fevers, as also in the previous year. This fever prevalence is

general all over the town of Buxar, and is said to be connected with the high level of the sub-soil water caused by the canals.

Prophylaxis by quinine was generally carefully carried out, and control experiments were instituted in three large jails. At Bhagalpur the incidence of malarial fevers and of bowel-complaints proved to be exactly equal in the gangs taking quinine and those who did not receive the drug. At Hazaribagh, however, a distinct advantage was apparent on the side of those who received the drug. The trial was only made at Buxar for one month. It is to be hoped that these valuable experiments will be continued till the question of the prophylaxis of malaria by quinine is finally settled. Tuberculosis of the lungs was much more prevalent and fatal than in former years. Pneumonia cases were less frequent. There were six cases and four deaths from cerebro-spinal fever. Dacca, Hazaribagh, and Bhagalpur Central Prisons showed remarkably low death-rates. The rates for the Alipore and Presidency Central Prisons were high on account of the number of cases of tubercle of the lungs. The open air treatment of these cases was carried out with success in Bhagalpur Jail, and should be tried at other jails. Midnapur, as usual, was not healthy; prisoners from Chaibassa especially fared badly there, and, in consequence, transfers from Chaibassa were stopped. All the jails with high mortality belonged to Eastern Bengal. In four jails there were no deaths.

North-Western Provinces and Oudh.—The sick and death-rates of the prisoners in these provinces were very satisfactory, the death-rate being only 22·25, or the second best on record for the province. All the Central Prisons show very satisfactory results; Bareilly Central Prison had a death-rate of only 8·86 per 1,000. There was a considerable decrease in the number of admissions and deaths from dysentery. The case-mortality is nevertheless high, 9 per cent., which probably in this instance points to a severe type of the disease. Isolation of dysentery cases and disinfection of stools is being more systematically carried out, but there is no unanimity of opinion as to the benefits or otherwise of isolation. The purity of the food and water still continues to receive attention. Pneumonia caused 584 admissions and 130 deaths, a case-mortality of 20 per cent.* It is, as Major Mactaggart writes, "next to dysentery the most fatal disease" in these provinces. The vast majority of superintendents are in favour of restricting the ventilation areas of sleeping barracks in the cold weather months.

Punjab.—There was a marked improvement in the health of the prisoners in the Punjab jails; contrasted with those of the previous year, both sick and death-rates were lower. As in 1897, the last half of the year was the more unhealthy. The Central Prisons were more unhealthy than the District Jails, and also more unhealthy than the Central Prisons of Bengal and the North-Western Provinces. The following figures show the steady improvement in the health of these jails in the past 20 years. In the first quinquennium the death-rate was 50·24, in the second 31·97, in the third 27·25, and in the fourth only 19·16 per 1,000. It is to be hoped the day may come when it may be reduced to 15 per 1,000. Leiutenant-Colonel Bate believes, and rightly too, that "reasonable attention given to health, far from weakening dicipline, is calculated to strengthen it." The better the general health, the more work can be got out of prisoners. The Mooltan Prison had a death-rate of 37·97, with eight deaths each from pneumonia, dysentery, and tubercle of the lungs—three essentially jail diseases. This jail is the infirmary jail, however, of the province, and received a large number of weak and sickly men. Lahore Central Prison had 50 deaths (35·29 per 1,000)—14 from tubercle, 10 from pneumonia, and 5 from dysentery. It is suggested that men transferred to Lahore Prison suffer more than the inhabitants of that district do when in the same jail. Previous to 1898, the Lahore Central Prison was usually very healthy.

Bombay.—The death-rate in the Bombay jails was only 24·72 per 1,000; very satisfactory in view of the fact that 11 jails out of 15 were considerably overcrowded throughout the year. The Bombay Common Prison (120·00), Thana (71·60) and Dharwar (45·17) showed a mortality in excess of the quinquennial average. In the Common Prison this was almost entirely due to a severe outbreak of relapsing fever—37 deaths. There were 59 deaths in Thana Jail—eight from remittent fever, nine from tubercle of the lungs, seven each from dysentery and scurvy, six from diarrhœa, and six each from pneumonia and other respiratory diseases. Out of 59 deaths, 41 took place among prisoners admitted from Nasik alone, most of whom came to jail in weak health. Malarial fevers prevailed much in Thana Jail, their probable origin being the moat

* Taking the 67 cases remaining from 1898 into account.

surrounding the jail, and the large marshy tract on three sides of the prison. This evil is stated to be irremediable. In Dharwar the mortality was raised by an outbreak of cholera which caused seven deaths. To improve the health of the Bombay prisoners, wheat was issued in lieu of bajri, etc., extra rations were given to the weakly, and cinchona alkaloids were freely administered. Potatoes were issued also thrice a week in lieu of ordinary vegetables.

Berar.—The jails of Berar were generally healthy during the year, the death-rate being only 13·32—that is, the lowest in all India. Intermittent fever caused the greatest number of admissions; tubercle, pneumonia, and dysentery, besides anæmia and debility, the greatest number of deaths.

Central Provinces.—The year is reported to have been an unusually healthy one, owing to a scanty rainfall and consequently less malaria. The death-rate per 1,000 fell from 34·63 to 24·59, and the constantly sick rate from 51·6 to 27·7. Nagpur Central Prison recorded a death-rate of only 8·66 per 1,000, a figure only a few times bettered by any large Central Prison in India. In Jubbulpore 11 deaths are stated to have been remnants of the previous famine. The high death-rate of Raipur was largely due to a severe outbreak of cerebro-spinal fever. There was only one mild outbreak of cholera in the jails of the province—six cases with one death at Bilaspur. The diet scales are liberal, but not more so than those of other provinces. Great attention was paid to the issue of antiscorbutics and good vegetables.

Coorg.—There is only one jail, at Mercara. The accommodation of the jail is 156. There was slight overcrowding for a short time only. The diet scales are liberal, and the water-supply is reported to be pure and ample. There were no less than 14 deaths, or a ratio per 1,000 of 127·27. Three deaths are returned as from "debility." The death-rate was much higher than in the previous four years. Bowel-complaints and malarial fevers prevailed. This is attributed to the famished condition of new arrivals in the jail.

Madras.—The lowness of the death-rate (16·13) is unprecedented in the annals of the Madras jails. This is attributed to the absence of any epidemic, and to the good health of those newly admitted to jail. The Central Prisons show a somewhat higher death-rate than the District Jails. The Rajamundry Central Prison showed a remarkable improvement, the death-rate falling from 123·03 per 1,000 in 1897, 193·23 in 1898, down to the very low figure of 14·29 in 1899. There was considerable overcrowding in three jails only. The reduction in the population of Rajamundry Prison was attended with the best results. There was a substantial reduction in the admissions to hospital for all forms of disease. The Inspector-General notes that the remarkably low death-rate of the year is largely to be attributed to the work of the medical officers in charge.

General Population.

General Remarks.—In this section of the reports issued year by year, the difficulties that confront the vital statistician when dealing with the figures presented in the annual reports of the Provincial Sanitary Commissioners have been repeatedly emphasized. One more year has elapsed since the census was taken, and it will be readily admitted that the figures of 1891 for an enormous and heterogeneous population like that of India must render close reasoning in respect of ratios calculated thereon a futile and well-nigh impossible task. On the one hand, there is the proverbial fecundity of the people, and, on the other, this is the land of capricious and devastating epidemics; during the inter-censal period, famine has invaded many of the most fertile and populous areas, and beyond the indirect loss of life this has involved, we have to take account of its effect in setting up currents of immigration and emigration which would vitiate the best accredited registration returns. These returns are certainly improving and Local Governments are alive to their responsibilities in this respect, but nothing approaching the actual facts can be obtained while the collecting agency in both urban and rural areas remains illiterate, and until municipal bodies recognize their obligation to enforce the bye-laws under which

registration is legally compulsory within the limits of their authority. With all these drawbacks the tendency is slowly but surely towards improvement so far as the elemental facts are concerned, the bare enumeration of births and deaths. Beyond this, when we come, for example, to the distribution of the causes of death under their various headings, we must at present be content to deal with contrasts in the gross, and the broad indications they afford, for the vast majority of natives are unattended by qualified medical men, no certificates are furnished, and friends and the reporting agency alike go no further in their discrimination of death-causes than is involved in a reference to the two great classes of "fevers" and "bowel-complaints."

In the following pages, little more is attempted than a broad survey of the outstanding features of the figures relating to births and deaths in the different provinces. These prefatory remarks will prepare the reader for general indications only of the ebb and flow of the chief vital phenomena, the resultant of many factors which are lost or obscured in the general movement; the material for refined speculation on some most interesting problems is wanting, but it is necessary to allude briefly to one or two of the more remarkable features of the figures as they stand. There is first the extraordinary contrast exhibited in the infantile mortality rates. Where registration is most defective, these rates are lowest and present the widest range. In a country where death registration by qualified medical practitioners is not required by law, where still-born children are not reported, save in the presidency cities, by any agency however defective, and where infanticide by accident or design is not associated with the moral stigma and penalty attached to it in Europe, it is only to be expected that a large proportion of the deaths of infants are entirely lost to account. In Calcutta and Bombay where registration is at its best and where, owing to the presence of plague in recent years, the causes of death have been more carefully scrutinized, we find that the numbers of still-births recorded reach the high proportions of 8·4 per cent. of the total births in the former city and of 18·7 per cent. in the latter. But the Bombay percentage cannot be taken to represent the normal relation, the prevalence of plague and other epidemic diseases,—relapsing fever, small-pox and cholera which were unusually rife in Bombay during 1899, together with the influx of a famine-striken population—have undoubtedly very largely increased the number of still-births.

It cannot be doubted that from the youthful ages of the mothers, the untoward sanitary conditions in which they live and the physical labour they are called upon to perform during pregnancy, the proportion of still-births is very high as compared with that recorded in Europe. As regards the infantile mortality, a general comparison of its relative incidence in urban and rural areas shows, as might be expected, that it is far higher in the large towns than in the country. While the mean rate in Bengal for 1899 is recorded as 184·8, that for Calcutta stands at 366·8; the rate for Lower Burma is 185·7 and that for Rangoon 357·4; the Presidency of Madras where registration leaves much to be desired and where, as the Sanitary Commissioner remarks that, "it was obvious that the death of an infant who had not managed to struggle through a year of life was often held unworthy of official recognition," the infantile mortality figure is 159·8, whereas for the city of Madras it is 275·5; in the Bombay Presidency the mean rate is 192·7, but in the city itself it rose to the enormous figure of 798·69, and although the conditions of recent years have been specially unfavourable owing to plague and scarcity and the immigration of destitute waifs, it was 461·3 prior to the advent of these troubles.

It cannot be considered that the figures recorded over the country generally adequately represent the loss of life among infants; the reasons for this have already been broadly stated and it will be evident, not only from the rates given in the body of this section under each provincial heading, but also from a perusal of the lowest rates returned by each, which are as follows:—

Lowest infantile mortality rates in districts—

Berar	196·6
Central Provinces	193·8
Punjab	156·0
North-Western Provinces and Oudh	150·6
Bengal	118·0
Burma...	102·0
Madras	96·7
Bombay	93·0
Assam...	17·8

The first five are the provinces in which the birth-rates are highest, and in the first four the mean infantile mortality rates are highest, and speaking generally it may be said that the infantile mortality figure presents a rough but approximately accurate test of the comparative adequacy of registration. Where the birth-rates are exceptionally low, we also find the most defective death-registration and it is easy to understand that deaths are more readily concealed than births, and the low birth-rate which *caeteris paribus* makes for a high infantile mortality figure is more than counterbalanced by the still more defective death-rate.

Famine and the birth-rate.—One other interesting feature of the returns for the year is the extraordinarily high birth-rate, which was general all over India ; it is not only that the figures are in the case of each provincial area notably higher than in any year of the inter-censal period, but the contrast with the low birth-rates of 1897, and, to a less extent, of 1898, renders the figures the more remarkable. Two considerations immediately arise in this connexion, *viz.*, that the comparatively low birth-rates of the two preceding years were directly or indirectly due to the prevalence of famine over wide areas and to the rise in prices of common food grains nearly everywhere ; and, second, that the phenomenally high figures for 1899 are to some extent enhanced beyond the true rates on account of the defective population figure which has not been corrected since 1891. But making full allowance for this statistical error, the enormous bound in the birth-rate disclosed by the returns for the year under review deserves more than passing allusion, if it be only by way of examining the basis for the existence of the popular idea that we see quoted as "Doubleday's well-known generalization," *viz.*, that one of the consequences of famine is to increase fertility. The question of the causes of the natural increase of a population is not a simple one ; it is confused by physiological and sociological factors of extreme complexity, and in India especially, where, owing to the periodic recurrence of scarcity, it confronts the enquirer, the data available for a critical examination are often unreliable or insufficient. It may be interesting, however, to look at the facts at our disposal, as they indicate that we need not postulate the existence of an apparently paradoxical phenomenon ; and that, so far as concerns the specific question raised in the generalization quoted, we may do well first to take account of some of the more obvious factors in action.

Briefly then, it may be stated that under normal conditions the birth-rate follows a well-defined and characteristic seasonal curve (see sub-section Bengal, page 80) ; during, and for some months subsequent to, the prevalence of scarcity from failure of the harvests we see the birth-rate fall and the normal curve modified out of recognition ; at the same time the death-rate rises to an abnormal extent, and the excess mortality falls in altogether undue proportion upon the age periods at the two ends of the scale. On the return of prosperity marked by the first good harvest, we find that the birth-rate remains abnormally low for some 10 or 11 months, when an extraordinary rise ensues which is maintained for several months at a fairly consistent level, the fluctuations of the normal curve being swamped by the high tide. But while the rise in the birth-rate is delayed for nearly a year, it is to be noted that the death-rate falls to below the normal some two or three months only after the replenishment of food stocks, and it remains consistently below the normal for a period, usually extending to a full year. Now it may be averred that the sexual instinct and the struggle for food are the two fundamental physiological forces that mould the social organism ; they both combine and separate individuals, and in them we find the basis of both the egoistic and altruistic instincts. They doubtless mutually subserve each other, but when the latter becomes sterner, the former suffers and the individual seeks to maintain life at any cost. Moreover, "the reproductive system appears to be far more susceptible than any other part of the organisation to the action of any change in the conditions of life."*

Now the physical and social conditions that promote the comparative fecundity of the Indian peoples have been well summarised as follows :—

† There is the tropical climate with its accompaniment of a low standard of requirements in the way of food and clothing, and an equality of temperature that admits of an out-door life to an extent that alone renders habitable the ordinary style of dwelling. There is the extent of arable soil, most of which yields to a comparatively simple cultivation the amount of food that suffices for the wants of the family. Strongest of all is the religious sanction, or the social influence, that contains within itself all the vitality of the popular belief, and according to which the want of a male heir leads to

* "Origin of Species."
† Bombay Census Report for 1881, page 29.

difficulties with regard to the inheritance of property, as well as to the omission of ceremonial observances of the utmost importance after death. There is, lastly, the stereotyped structure and want of elasticity inherent in the form of Indian society, which retards to an indefinite degree the development of a standard of comfort in advance of that of the preceding generation, and thus discourages the foresight which, originating in the desire of rising in the social scale, has an enduring effect on the marriage relations of the class which at once acquired it.

That the result of all these sanctions to propagate their kind is not greater than it is, is doubtless due to the condition of comparative want, at any rate to a standard of diet short of full physiological requirements, for although the birth-rate is far higher than that of England, it is to be noted that the full powers of the people are exercised in this respect, whereas, as Farr has shown, there is an immense reserve of unmarried but marriageable population in England. No less than 88 per cent. of the total number of women in India between the ages of 15 and 39 were shown to be married at the last census. While the disposable income of the people scarcely varies, the harvests vary greatly, and among people living from hand to mouth on the produce of the soil, the effect of a bad season speedily makes itself felt; with the insufficiency of food comes less resistance to disease, and beyond this the loss of a harvest cuts off the recourse to ready money in the way of loans from the local bankers. The milk cattle die in enormous numbers and the young children are the first to suffer privation, and a further drain is made upon the maternal vitality which it is unable to meet.

What happens now is that marriages are deferred; not only are the times unpropitious, but the necessary funds for the ceremonial festivities, which are regarded as essential, are not forthcoming. The able-bodied men first leave their homes in search of work in less distressed areas or on relief works, and these no doubt are often accompanied by their women, or followed by them later. There is undoubtedly enforced celibacy among a large proportion of the population and with this there is also a depression of the vital functions, affecting that of reproduction. It has been noticed that the women resorting to relief camps are rarely pregnant, that is to say, that there is marked diminution in the normal proportion of pregnant women. It is now that the birth-rate falls and that the death-rate rises, but under present conditions of railway communication and relief works, it is the very young and the old who succumb, leaving for the most part the more robust section of the population, that included in the child-bearing age-periods, severely affected by privation and with the vital functions at their lowest ebb, but surviving to resume the exercise of these on the return of favouring conditions. It may be noted that in the old days when famine desolated a province cut off from outside aid and when adequate measures of relief were not organised, the adult population suffered far more severely (Madras famine 1877), and as a consequence the birth-rate fell off markedly for a number of years, until indeed a young population reaching the child-bearing age brought about a sudden increase, a fact that bears forcibly upon the point under discussion.

With the recurrence of the first bountiful harvest, the whole course of events is reversed; the wanderers return to their homes, loans are negociable, there is an excess number of marriages, many of those deferred under stress of want being consumated; co-habitation is resumed by those temporarily separated and the sexual instinct depressed by acute privation, now resumes its imperious sway fortified by comparatively abundant food and freedom from anxiety, as also there are fewer mouths to fill, the unproductive members having largely died off. There are therefore all the conditions promoting an abnormal excess of conceptions during the few months following this resumption of the placid tenour of home life and the establishment of many new homes. If any stimulus were necessary to the production of offspring, we might find it in the great loss of young children sustained by the people during the famine and the imperative obligation to supply their places and remove the religious and social disabilities their absence entails. Not only therefore have we a larger number of effective agents for procreation in the period in question, but it is probable that the rhythmical impulse that attends all natural operations has gained in force by temporary rest and suspension, and as a result we must look for more than the normal average of conceptions and births; but these take place, as the figures prove, subsequent to the return of the first abundant harvest and all it connotes, and long after the fall in the death-rate announces a return of healthy and comparatively prosperous conditions. If we take into account the number of years to each birth per married woman at the reproductive ages, which in some countries is $2\frac{1}{2}$, we shall probably find nearer 2 in India, and if conceptions are deferred in one year, there will probably be an excess in the next to redress the balance. Farr called marriage the barometer of prosperity; this is also in a sense the case in India, as regards the indication afforded by a brisk "fall," and as a war diminishes the number of marriages by temporarily removing

many men of the procreative age-periods, so an excess of marriages naturally follows peace. And it is the same with famine, in the case of which there are considerations to be added in this country, which tend to enhance the natural results.

Thus we see that in the Central Provinces where famine conditions prevailed from the autumn of 1896 to that of 1897 the birth-rate was considerably below the normal from and including September 1896 to August 1898; that is to say until some 10 months after the first good harvest. Moreover, although the birth-rate is abnormally low throughout this period, we find it lowest of all in the last 10 months thereof, *viz.*, after the return of prosperity, but before its effects can be exhibited in the birth-rate. The birth-rate for the actual famine period was 28·5, while it was only 19·5 for the 11 months immediately following, October 1897 to August 1898, an annual rate of only 21·3 against the decennial mean (before the famine) of 37·9.

In September 1898 it was about normal, but in October, and thence on throughout the year 1899, it was consistently above the normal with little or no fluctuation until we get to the last two months, the rates for which more nearly approached the mean. The monthly death-rate, however, in great excess throughout the famine period, fell to about the mean in January 1898, and to below the mean in February where it remained throughout the whole of that year.

Again in the other province chiefly affected, *viz.* the North-Western Provinces, where famine prevailed during a similar period over a large, but not the whole, area; the birth-rate shows an extraordinary bound in August 1898, some 10 months after the first good harvest, and the excess over the normal mean is maintained consistently throughout the rest of that year and throughout 1899. The death-rate, high throughout the famine period, fell to normal in January 1898, and was consistently below the mean throughout that year.

It is true that in certain selected districts which have been severely stricken by famine, the birth-rate after recovery shows a higher proportional rise than that of others more fortunately situated, but this is exceptional and does not apply to all famine districts; moreover, these districts never show the highest birth-rates, and districts affected only indirectly by high prices and withdrawal of grain supplies share in the general rebound exhibited by the birth-rate, if not always yet often to as large an extent. It is impossible to appraise exactly all the factors at work in the case; a tide of immigration often sets in towards a distressed area owing to liberal relief works, &c., but if what has been said here on the whole subject be accepted, there will be no difficulty in understanding why the rebound in the birth-rate when it occurs should be proportionally higher in the affected tracts.

It is not therefore difficult to understand that in prosperous years following famine the death-rate will be comparatively low and the birth-rate correspondingly high, and that there will be a larger natural increase of the population than in what are called normal years. The weaklings, the old and the very young, have to a large extent died off, and this leaves a more resistant population, with fewer unproductive members to support; the life of the community is resumed under more favourable auspices, its future fortunes, under present social and economic conditions, depending chiefly on the process of the seasons.

It can be asserted with confidence that one of the chief physical factors affecting the birth-rate in India is the relative abundance and scarcity of the common food staples. This is strikingly demonstrated if the market prices of the latter in almost any area are plotted upon a scheme in association with the birth-rates of the corresponding subsequent years. A fall in prices is almost invariably followed by a rise in the birth-rate, and conversely; and although every petty fluctuation of the former may not find a corresponding expression in the latter, and although the effect may not always bear an exact proportion to the cause, yet both marked and sustained movements in prices invariably yield the results indicated. Moreover, when we distinguish the special local areas in a province which are associated with the highest and lowest birth-rates over a series of years, we generally find that the common food staples have been respectively more or less abundant. Of course social customs, *e.g.*, age at marriage, widow re-marriage, polygamy, &c., and economic conditions involving tides of emigration and immigration have a marked effect in modifying the general procession of the birth-rate, but in populations under approximately equal conditions in these and other respects, the quantity of food available appears to determine in largest measure the natural increase or decrease of the people. When, however, we come to compare different geographical and racial areas, the relation is not so obvious, and other complicating factors intervene (*see*

p. 81). As regards marriages among Hindus, which take place under religious sanction in certain propitious months, it can be said that occurring as these do chiefly from the middle of November to the middle of March and from the middle of April to the middle of July,* one would expect the highest monthly incidence of the birth-rate in the period from August to April, inclusive, while the curve should be at its lowest in May, June and July, and this indeed is the almost universal case under normal conditions.

Births.—The following statement furnishes a brief epitome of the birth statistics in 1898 and 1899, showing the numbers of the urban and rural populations under registration; the numbers of children born; the millesimal birth-rates, with the average rates of the previous five years; and the percentages of male to female births.

Birth Statistics.

Province.		Number of Municipalities and towns in which births were registered.	Number of rural circles in which births were registered.	Population under Registration. In Municipalities and towns.	Population under Registration. In Districts, excluding towns.	Population under Registration. Total.	Total number of births registered.	Ratio of births per 1,000 of population.	Highest birth-rate in any one district.	Lowest birth-rate in any one district.	Number of males born to every 100 females born.	Excess or deficiency of births compared with deaths.	Mean ratio of births per 1,000 during previous five years.
Bengal	1898	151	559	3,452,892	67,616,725	71,069,617	2,543,701	35·79	43·59	13·98	106	+ 9·22	35·61
	1899	152	560	3,461,183	67,608,434	71,069,617	3,053,178	42·96	53·28	16·14	105	+11·75	35·63
Assam	1898	21	60	106,397	4,914,687	5,021,084	147,889	29·46	38·18	18·66	107·65	- 6·69	31·70
	1899	23	64	109,224	4,941,366	5,050,590	179,027	35·45	41·43	21·01	106·03	+ 4·44	31·58
North-Western Provinces and Oudh.	1898	98	1,216	3,221,272	43,683,519	46,904,791	1,751,725	37·35	53·93	25·99	108·05	+ 9·97	36·41
	1899	460	851	3,236,425	43,668,366	46,904,791	2,255,627	48·09	63·48	28·07	107·43	+14·90	35·69
Punjab	1898	150	448	2,010,390	18,551,934	20,553,982*	841,869	41·0	53·8	21·8	110·4	+ 9·9	41·7
	1899	150	464	2,010,390	18,551,934	20,553,982*	994,001	48·4	69·1	21·7	109·6	+18·8	42·9
Central Provinces†	1898	73	163	816,417	8,684,984	9,501,401	284,176	29·91	45·54	22·18	106·69	+ 5·61	33·80
	1899	73	161	816,417	8,684,984	9,501,401	449,895	47·35	60·06	38·58	105·35	+19·26	32·14
Berar	1898	38	67	356,002	2,496,823	2,852,825	89,414	31·3	33·6	28·4	105·2	+ 7·9	37·6
	1899	38	67	356,002	2,496,823	2,852,825	144,034	50·5	54·3	45·8	106·4	+10·6	36·0
Madras	1898	93	181	2,538,033	30,710,147	33,248,180	911,742	27·4	41·5	18·6	104·3	+ 6·4	28·5
	1899	93	181	2,538,033	30,987,761	33,525,794	1,048,335	31·3	40·5	22·3	103·9	+11·2	28·6
Coorg	1898	5	5	15,511	157,544	173,055	2,795	16·15	19·05	11·58	107·34	-15·28	24·18
	1899	5	5	15,511	157,544	173,055	4,427	25·59	32·53	21·07	95·80	- 2·42	23·16
Bombay	1898	63	220	2,304,373	16,515,973	18,820,346	582,371	30·94	42·33	13·08	108·19	+ 1·78	35·28
	1899	63	220	2,304,373	16,515,973	18,820,346	685,348	36·42	52·85	12·88	108·01	+ 0·70	34·41
Lower Burma	1898	34	196	582,692	3,928,005	4,510,697	153,838	34·11	45·24	18·77	109	+ 8	29·36
	1899	33	193	579,606	3,881,421	4,461,027	165,229	37·04	46·08	17·55	108	+10	30·97

* Excluding Europeans and Eurasians. † Excluding Zamindaris of the Chhattisgarh Division.

In 1899 the highest birth-rates were registered, in the Berar 50·5 per 1,000, the Punjab 48·4, the North-Western Provinces and Oudh, 48·09, and the Central Provinces 47·35. Bengal follows with 42·96 per 1,000. The lowest rates were, as last year, those returned by Assam, 35·45, Madras 31·3, and Coorg 25·59.

Not only were the birth-rates recorded in 1899 higher in every province than those of the preceding year, but the increase, large in most instances, is in some cases quite phenomenal; for instance, in Berar it amounted to over 19 per 1,000; and in the North-Western Provinces to nearly 11 per 1,000. In the aggregate no less than 1,670,491 more births were registered all over British India in 1899, than in 1898, and the excess over the number for 1897 was actually 1,773,794. In view of the remarks with which this section is prefaced, the subject requires no further discussion; these extraordinary results must be read in the light of the restored prosperity of the people and of the low death-rate, indicating the generally higher standard of health which marked the previous

* The months of Sawan, Bhadon, Asoj and Kirtik (from middle of July to middle of November) are unpropitious for marriages.

year. In only one area, viz., in the small province of Coorg, were the recorded births less numerous than the deaths, but there are special local conditions, which will be alluded to later, to account for this.

The percentage of male to female births ranged from 109·6 in the Punjab and 108·09 in Bombay to 103·9 in Madras and 95·8 in Coorg.

Deaths.—The next statement gives details of the mortality in the different provinces in 1898 and 1899.

Death Statistics.

Province.		Number of Municipalities and towns in which deaths were registered.	Number of rural circles in which deaths were registered.	Number of Deaths Registered.			Ratio of Deaths per 1,000 of Population.			Highest Death-rate.		Lowest Death-rate.		Mean Death-rate during previous 5 years.			Number of deaths of males to every 100 deaths of females.
				In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	In Municipalities and towns.	In Districts, excluding towns.	In Municipalities and towns.	In Districts, excluding towns.	Total.	
Bengal	1898	151	559	94,980	1,793,488	1,888,468	27·50	26·52	26·57	52·84	41·50	9·98	15·29	34·15	32·23	32·32	117
	1899	152	560	114,593	2,103,650	2,218,243	33·10	31·11	31·21	69·18	50·91	12·07	19·93	33·56	31·91	31·99	113
Assam	1898	21	60	4,260	177,267	181,527	40·04	36·07	36·15	67·39	47·32	20·54	25·49	44·54	36·15	36·53	115·90
	1899	23	64	4,073	152,522	156,595	37·29	30·87	31·01	76·79	44·41	9·23	22·93	45·01	37·33	37·50	117·09
North-Western Provinces and Oudh.	1898	98	1,216	107,619	1,176,700	1,284,319	33·41	26·94	27·38	48·92	42·31	16·93	18·82	40·38	33·42	33·90	109·77
	1899	460	851	126,366	1,430,455	1,556,821	39·04	32·76	33·19	62·70	42·04	20·32	21·17	41·12	34·07	34·56	110·45
Punjab	1898	150	448	66,439	571,685	638,124	33·05	30·82	31·05	53·86	40·10	13·38	16·90	35·36	30·85	31·30	107·1
	1899	150	454	65,492	542,223	607,725	32·58	29·23	29·57	44·90	41·98	12·07	15·94	35·31	31·50	31·89	107·2
Central Provinces.†	1898	73	163	22,552	208,355	230,907	27·62	23·98	24·30	55·66	35·35	14·00	19·63	45·92	43·89	44·06	113·11
	1899	73	161	27,852	239,078	266,930	34·11	27·53	28·09	70·28	46·06	15·92	22·48	46·23	43·11	43·38	118·51
Berar	1898	38	67	9,086	57,720	66,806	25·5	23·1	23·4	34·7	24·6	15·6	20·3	not stated	44·2	44·2	112·9
	1899	38	67	15,178	98,814	113,992	42·6	39·5	39·9	55·8	51·5	28·8	30·5	42·9	42·3	42·3	111·8
Madras	1898	93	181	75,672	623,436	699,108	29·8	20·3	21·0	45·2	29·2	8·1	14·8	29·1	20·3	21·0	106·3
	1899	93	181	73,932	601,162	675,094	29·1	19·4	20·1	58·2	30·1	7·4	13·3	[illegible]	20·6	21·3	103·4
Coorg	1898	5	5	648	4,792	5,440	41·78	30·42	31·44	73·76	38·92	19·88	24·13	38·75	30·31	31·07	130·50
	1899	5	5	553	4,292	4,845	35·65	27·24	28·00	49·47	34·64	21·64	20·97	39·87	31·56	32·36	129·62
Bombay	1898	63	220	110,336	438,489	548,825	47·88	26·55	29·16	106·77	64·76	9·09	6·95	37·89	31·09	31·92	111·06
	1899	63	220	147,705	524,564	672,269	64·09	31·77	35·72	228·77	46·67	10·35	11·79	41·45	31·04	32·31	112·00
Lower Burma ..	1898	34	196	19,286	98,570	117,856	33·10	25·09	26·13	43·39	32·05	17·38	17·06	29·67	22·63	23·52	130
	1899	33	193	19,973	101,798	121,771	34·46	26·23	27·30	59·09	32·98	15·44	20·37	30·63	23·47	24·40	129

* Excluding Europeans and Eurasians. ‡ Excluding Zamindaris of the Chhattisgarh Division.

The highest death-rates registered were 39·9, in Berar, 35·72 in Bombay and 33·19 in the North-Western Provinces and Oudh; and the lowest were 28·0 in Coorg, 27·3 in Lower Burma and 20·9 in Madras.

As compared with the previous year, which was an extraordinarily healthy one, the death-rates in six of the provinces were higher, the most marked rise being recorded in Berar, with the large increase of 16·5 per 1,000; but in four provinces, viz., in the Punjab, Madras, Assam, and Coorg the rates were even lower than in 1898. In only two areas, namely, in Bombay and Lower Burma, were the rates higher than the quinquennial averages; in the former, the increased prevalence of plague and the failure of the autumn harvest account for the increased mortality, and in the latter most, if not the whole, of the rise may fairly be attributed to improved registration.

In every province the urban death-rates were higher than the rural, and the contrast is very marked in Bombay and Madras.

The urban rates were as in the case of the combined death-rates, higher than in 1898, save in the four provinces in which the recorded mortality decreased in the year under review, and the same remark applies to the rural death-rates.

The following table exhibits the monthly distribution of the mortality throughout the year :—

Statement showing Deaths from all causes, according to Months, in the different Provinces of India during the year 1899.

PROVINCES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION.	
														1899.	1898.
Bengal	198,659	136,104	143,261	161,255	179,945	132,632	156,539	186,752	174,288	244,253	256,785	247,770	2,218,243	31·21	26·67
Assam	14,555	12,350	12,126	11,309	12,716	11,744	11,108	11,460	11,710	13,673	16,708	17,136	156,595	31·01	36·15
North-Western Provinces and Oudh.	111,313	95,098	103,731	127,978	140,144	122,090	109,467	152,193	166,287	151,287	139,442	137,791	1,556,821	33·19	27·38
Punjab	54,278	45,047	46,558	43,563	50,748	45,114	43,899	57,163	52,133	53,004	57,338	58,880	607,725	29·57	31·05
Central Provinces*	22,149	19,887	24,694	28,474	24,920	23,059	19,613	21,333	21,544	20,789	19,294	21,174	266,930	28·09	24·30
Berar	7,537	6,328	10,505	11,113	11,946	9,275	8,399	10,046	8,923	9,428	9,539	10,953	113,992	39·9	23·4
Madras	72,315	55,359	51,694	47,575	53,876	50,809	52,776	51,889	51,974	57,113	62,743	66,971	675,094	20·1	21·0
Coorg	376	335	334	319	394	550	586	436	435	345	312	423	4,845	28·00	31·44
Bombay	58,587	53,475	65,190	55,970	49,878	42,282	50,585	59,631	59,460	60,374	54,436	62,401	672,269	35·72	29·16
Lower Burma ..	8,287	8,386	9,440	10,008	9,570	10,709	12,678	11,932	10,380	10,460	10,024	9,897	121,771	27·30	26·13
Upper „ ..	1,657	2,495	4,282	4,729	4,508	5,368	5,250	4,856	4,284	4,409	4,637	5,140	51,615	21·03	..
Ajmer-Merwara ..	1,362	1,470	1,852	1,511	1,460	943	1,028	1,554	1,059	1,262	1,745	2,767	18,013	33·21	22·14
Mysore	10,072	7,851	6,862	6,130	6,359	6,002	6,521	6,226	5,994	6,459	7,292	8,166	83,934	17·33	19·98
TOTAL ..	561,147	444,185	480,529	509,934	548,464	460,577	478,449	575,471	568,471	632,856	640,295	649,469	6,547,847	29·95	27·13

* Excluding Zamindaris.

The figures for each provincial area must of course be studied separately and in connexion with the meteorological data, but speaking generally of the mortality as a whole, it was higher in every month of the year when compared with 1898, the excess being most marked in the months of May and August. A feature of the year under review is the exceptional incidence upon the last quarter, probably attributable to the early failure of the monsoon and the sudden rise in the prices of the common food-grains and the presence of famine in several areas.

The following paragraphs contain a summary of the more important figures reported from the different provinces.

Bengal.—The total number of births registered in Bengal in 1899, was 3,053,178 or 509,477 more than in 1898, and the figures are notable as being by far the largest hitherto recorded in the sanitary history of the province. The millesimal ratio calculated on the census population of 1891, which had declined from 38·03 in 1896 to 36·94 in 1897 and to 35·79 in 1898, rose to 42·96, which is 7·33 per 1,000 higher than the mean of the quinquennium ending with 1898. Making every allowance for the error involved by the calculation of the rate on an obsolete census figure and for the effect of more complete registration, of which there is indubitable evidence, this increase is doubtless due to the return of prosperity owing to the occurrence of two good harvests in succession, together with the exceptional healthiness of the year 1898. "With the disappearance of famine which led to the breaking up of families and to the emigration of the males of the poorer classes in search of employment, there was a return of these to their homes during 1898 which happily was a year of plenty." The exceptionally high birth-rate which was a marked feature of the last four months of that year, was maintained throughout 1899, the excess over the monthly averages being greatest in the first five months.

The figures recorded for the period from September 1898 to May 1899 give a birth-rate of 35·05 per 1,000 which is at the rate of 46·7 per annum, although three of the months included are those in which the birth-rate is normally at its lowest. Further, the corresponding period of extraordinary conceptions must naturally be taken to be that from December 1897 to August 1898, and from figures given in the Sanitary Commissioner's report we find that period to have been one of extraordinary low death-rate, *viz.*, 23·07 per 1,000, against a mean of 25·94 for the eight-year period 1892–99 for the same months. There can be little doubt that the broad facts available lend support to the view that the return of large numbers of married males to their homes late in 1897 and in the early part of 1898, to find food cheap and abundant, and to enjoy a period of

exceptional immunity from disease, affords the best explanation of the phenomenal birth-rate of the year under review. At the same time the last word on a problem which has so long exercised vital statisticians has not been spoken, when it is sought to connect a high birth-rate with a corresponding low death-rate during the period of conception, and with the nature and amount of the food available for the population generally. This is a view held by the Sanitary Commissioner, who appeals to the monthly birth and death rate curves of his own province, and to the records of Punjab, the North-Western Provinces, and the Central Provinces, which have consistently held the first places as regards birth-rates, which he attributes to their "salubrious climate and comparatively nutritious dietary."

The most striking feature of the birth-rate when plotted month by month upon a scheme is the great and sudden rise in October followed by a consistently high rate in the succeeding winter months up to, and including, March but excluding February; the April–September period being one of comparative depression with the minimum in June. The death-rate curve is very similar; a considerable rise in October, reaching its summit in November and December, but still above the average till April (again excluding February), it is below the average from May to September with the minimum in June. It is manifest therefore that the curves run parallel in a notable degree, and if the birth-rates be plotted against the death-rates of the nine months antecedent, *e.g.*, the October birth-rate against the January death-rate and so on in respective sequence, we do not find that the curves are consistently farthest apart, as they should be on the view put forward.

But, on the contrary, it may safely be said that whatever be the causes which determine the fecundity of the population, and health is *cæteris paribus* admittedly one, the death-rate, as regards India, rather depends on the birth-rate than *vice versâ*. One-fourth of all deaths registered are among children under one year of age; infants are the most susceptible to all the conditions connoted by the term "seasonal influence," and the high birth-rate in the autumn and winter, the most unhealthy period, is accompanied by the deaths of enormous numbers of weaklings.

It is also doubtful whether the cause of the differences in the birth-rates, *when the different provinces are compared*, can be referred to the respective amounts and qualities of the dietaries or to the climatic conditions. The divisions of Behar, which approximate closely in these respects to the North-West Provinces, do not yield the highest birth-rates in Bengal, and in the case of the Central Provinces, cited in this connexion, we find that those areas in which the staple dietary is very similar to that of Bengal have a higher birth-rate than those which resemble the North-West Provinces in this respect. Certain marked local sociological characteristics have an influence that cannot be overlooked.

The highest district birth-rates were 53·28, 50·53 and 50·18 registered respectively in Palamau, Gaya and Hazaribagh; and the lowest were 31·99, 30·17 and 16·14 in the 24-Parganas, Hooghly and Calcutta, which held the same position on the list in the previous year. All the districts except Jalpaiguri, Rajshahi and Jessore show a considerable increase, thirty-two districts having returned a rate of over 40 per 1,000 against ten only in 1898.

The three exceptions mentioned show a trifling decline as compared with the previous year, but are well above the quinquennial mean. The causes of the low rate in the Calcutta (urban) district, and of the comparatively lower rate in urban circles generally as compared with rural circles, were fully discussed in this report for 1898. Of a total of 151 towns, all but 31 returned a higher birth-rate in 1899 than in the previous year, and in only 73 did the death-rate exceed the birth-rate.

As regards rural areas, it is noticeable that as many as 247 returned a birth-rate in excess of 45 per 1,000, against only 50, 82 and 85 in the three preceding years respectively. This is satisfactory, but at the same time it has to be recorded that in 16 instances the number of deaths exceeded that of the births. In most cases this is accounted for by an exceptionally high death-rate, but there are still a few in which registration must be at fault.

The provincial percentage of male to female births was 105, against 106 in 1898, and it varied from 117 in Hooghly to 102 in Hazaribagh, Ranchi and Palamau, and three other districts; it will be remembered that in the former area the birth-rate was at its lowest, and in the latter places at its highest.

The total number of deaths registered was 2,218,243, as compared with 1,888,468 in 1898, which was the healthiest year since 1890; the death-rate calculated on the census population rose from 26·57 to 31·21 per 1,000, but the latter figure should obviously be compared with that for the quinquennial mean ending 1898, which stands at 31·99. The result bears out the view that, judged by the death-rate, the year 1899 ranks as one of

comparative healthiness, especially when the natural increase of the population over that of the census figure is borne in mind. Although cholera is credited with 107,678 deaths during 1899, against 65,024 in 1898, the year of phenomenal immunity from this disease, yet the death-rate per 1,000 was only 1·51 as compared with 2·53 the mean ratio for the previous quinquennium.

Again, the mortality from fevers, which stood at the exceptionally low millesimal ratio of 19·97 in 1898, rose to 22·61 in 1899, but this again was 0·72 per 1,000 lower than the mean ratio for the five preceding years. The excess of the number of deaths over the mean for the decade is due almost entirely to the heavier mortality among infants, a result which the extraordinarily high birth-rate would lead one to expect, but the infantile mortality figure works out at the comparatively low rate of 184, as compared with 173 in the previous year, which stands out as the healthiest since 1890.

The death-rates from small-pox, dysentery and diarrhœa, and injuries show little variation from those recorded in the previous year, but there is an increase in the rate from "other causes" amounting to 1·31 and 1·53 per 1,000 over that of 1898, and over the mean of the previous decade, respectively. The increase under this head was more notable in the urban than in the rural areas, and must be considered too large and too sudden to be altogether referable to improved diagnosis. The prevalence of plague renders it imperative to scrutinize closely any notable increase in the number of deaths classed under this anomalous and comprehensive heading, in view of the well-known practice of concealing the real cause of deaths from plague.

The highest district death-rates were recorded in Malda, 50·75, Faridpur, 45·44, and Murshidabad, 43·0; and the lowest in Manbhum, 20·24, Sonthal Parganas, 20·15, and Singhbhum, 19·97. In the rural areas the average rate was 31·11 against 33·10 in towns, among which the rates varied from 69·18 in Puri, the well-known pilgrim resort, where cholera accounted for 33·34 per 1,000 of the total mortality, and 53·42 in Bhadreswar, where the deaths attributed to fevers and dysentry accounted for four-fifths of the total, to 12·87 in Raghunathpur, and 12·07 in Maniktala, which were also at the bottom of the list last year. Fever was extremely prevalent in the towns of Sherpur, Nator, Jangipur, English Bazar and Rampore Baolia, and this cause alone carried off 41·91, 36·90, 40·33, 33·21 and 33·91 per 1,000 of the population in these places respectively. No less than 11 rural areas returned a death-rate in excess of 60 per 1,000, and this also is attributable to the excessive mortality from fever in the Murshidabad, Darjeeling (Terai), Faridpur and Malda districts, the general health in Murshidabad and Malda being the worst ever recorded.

Among the various sects, Muhammadans had the highest death-rate, 34·92 per 1,000, which is 5·26 per 1,000 in excess of the decennial mean for that sect, and this is to be largely attributed to the fact that the Musalman population far outnumbers the Hindus in the districts just alluded to, and in some others, such as Jessore, Rajshahi, Dinajpur, Pabna and Dacca, where the mortality was at its highest. The death-rate among Hindus was 29·87, while that for Christians was 22·81, followed by 20·91 for "other classes," and 19·85 for Buddhists. These rates are higher than those returned in the previous year, save in the case of Buddhists, which shows a decline of 5·76 per 1,000, and this is attributed to the exceptional healthiness of the Chittagong district during 1899, a district where more than half the Buddhist population is located.

The seasonal incidence of mortality presented no important features of deviation from the usual curve.

Male infants died at the rate of 272·64 per 1,000 against 215·65 in 1898, and female infants at the rate of 221·01 against 170·28, but the infantile mortality figures, which are more reliable, as calculated on the registered number of births rather than on the obsolete census figures, are 194·15 and 175·05 for males and females respectively, as compared with 183·41 and 162·75 in the previous year. The rates among boys and girls of over one and under five also show a considerable increase over those of 1898, *viz.*, 45·35 and 38·93, against 37·18 and 31·23 per 1,000 respectively. As usual the male death-rates were higher than those returned for females at all age-periods, the averages being 33·33 and 29·10 for males and females respectively.

Port of Calcutta.—The number of European seamen who arrived in the port during 1899 was 19,647, the daily average population being 1,200, or 32 less than in 1898.

The total number of deaths among them was 60, equal to a death-rate of 50·0 against 22·72 per 1,000 in 1898; the death-rate is indeed the highest recorded since 1894, and 8·33 per 1,000 of the total were attributed to cholera.

Among the native floating population of the port, estimated at 25,630, there were 125 deaths reported, equal to a death-rate of 4·87 per 1,000, as compared with 4·70 per 1,000 in 1898.

Assam.—The vital statistics of the Naga Hills and the Garo Hills districts, hitherto treated separately, have been incorporated in the general statistics of the province ; there still remain certain outlying parts of these mountain areas, the estimated population of which is 426,243, in which registration still awaits introduction. Taking the province as a whole, the number of births recorded in 1899 was 179,027, against 148,956 in the previous year, and the birth-rate rose from 29·49 to 35·45 per 1,000, the highest on record. The highest district rates were returned from Goalpara (41·43), Garo Hills (41·23), Cachar (39·35), Sylhet (38·02) and Lakhimpur (37·72) ; and at the other end of the scale come Nowgong (21·01), Khasi and Jaintia Hills (21·51) and Kamrup (31·05), following the usual order which has been maintained during the past few years. There is still evidence of defective registration, especially in the Brahmaputra valley, where the recording agents are unpaid village head-men, and the figures for the districts of Kamrup and Nowgong and of several of the *Sadr* towns are particularly open to suspicion. The average percentage of male to female births fell from 107·65 to 106·03, and ranged from 133·33 in the Naga Hills to 92·38 in the Khasi and Jaintia Hills.

The total number of deaths recorded, which was 182,763 in 1898, fell to 156,595, and the rate per 1,000, from 36·17 to 31·01, or 6·49 per 1,000 below the quinquennial mean. Among the districts the highest rates were 44·86 in Darrang, 38·88 in Goalpara and 35·56 in the Garo Hills ; and the lowest were 23·58 in Kamrup, 24·96 in the Khasi and Jaintia Hills and 25·29 in Cachar. In rural areas the average death-rate was 30·87 per 1,000 against an average in the towns of 37·29, and among the latter the rates ranged from 76·79 in Tezpur (Darrang) and 62·65 in Gauhati (Kamrup) to 16·0 and 9·23 in Jowai and Shillong and in the Khasi and Jaintia Hills, respectively.

Hindus died at the rate of 27·43 per 1,000, followed by Christians (30·14) and Muhammadans (32·36) ; while "other classes," who numbered 520,161 at the census of 1891, yield the highest death-rate, 47·92. This latter figure would doubtless be largely modified if account were taken of immigration, but the enormous death-rates returned among "other classes" in Cachar (121·41) and Sibsagar (116·12) are far from satisfactory, and demand enquiry if only in the form of some attempt to estimate the true population at inter-censal periods by taking account of the annual influx of immigrants.

Male infants died at the rate of 200·28 and female infants at the rate of 175·89 per 1,000, calculated on the census figures of 1891 ; the infantile mortality rate, for both sexes combined, was 186·45, and ranged from 296·46 in Goalpara, where registration is at its best, to the absurd figure of 17·86 in the Naga Hills, and of 96·32 in Lakimpur. Boys and girls of over one and under five years are credited with death-rates of 29·52 and 27·77 respectively, and there is a decrease in the rates at all age periods corresponding to the lower general mortality. At all age periods, save 15–30, the male rates were the higher, the averages being 32·35 for males and 29·52 for females.

North-Western Provinces and Oudh.—Following on the exceptionally healthy year 1898, the chief feature of the vital statistics of the North-Western Provinces and Oudh is an extraordinary high birth-rate, with a death-rate which although in excess of the previous year was still below the quinquennial mean. The total number of births recorded in 1899 was 2,255,627 against 1,741,725 in the previous year, giving a birth-rate, the highest on record, of 41·09 as compared with 37·35 in 1898 and with 35·69 the average for the previous five years. While the districts, which under ordinary conditions exhibit the greatest fecundity, maintain their pride of place, the most astonishing increase in the birth-rate during the year under review is recorded of many of the areas which were stricken with famine in 1897 ; for example, one district, Banda, which yielded a rate of 13·76 in 1897 shows the enormous advance to 41·52 in 1899. Still it is among the western districts that as usual we find the actually highest rates ; Bulandshahr with 63·48, Etah with 61·14, Budaon with 59·24 as in previous years ; while the lowest were registered in Naini Tal, 28·07, Dehra Dun, 29·70, and Jaunpur, 36·52, and on the whole the eastern districts are marked by the tendency to return the lowest rates. In every district save two, viz., Naini Tal and Dehra Dun, births were more numerous than deaths, the excess of the former on the combined provincial rates amounting to nearly 15 per 1,000. The municipal birth-rate averaged 47·24 per 1,000 against 36·44 in 1898, with variations ranging from 67·99 in Kandhla to 11·58 in Mussoorie, where there is a large excess of adult males in the population.

The percentage of male to female births, which in 1898 was 108·05, fell to 107·43, and ranged from 120·68 in Dehra Dun to 100·40 in Garhwal.

The total number of deaths recorded was 1,556,821, or 272,502 more than in 1898, giving ratios of 33·19 and 27·38 respectively against a quinquennial mean of 34·56, a result which must be regarded as indicating a comparatively fair general standard of health, considering the large number of births and the high mortality among infants. The highest district death-rates were recorded in Mainpuri (41·93), Etah (41·75), and Farukhabad (40·69), and the lowest in Danda (21·24), Hamirpur (24·11) and Gorakhpur (25·01). The urban death-rate was 39·04 against 33·41 in 1898, and that for rural areas 32·76 against 26·94 in the previous year. In 18 out of the 104 municipalities the deaths exceeded the births in number, as compared with 31 in 1898 and 76 in 1897, which suggests a higher standard of health and more complete registration.

Among the various sects, Hindus had the highest death-rate, 33·52, followed by Muhammadans with 31·55 ; the recorded rate for Christians, 11·62, and for "other classes," 18·36, are open to suspicion, on account of the extraordinary variations in the rates returned by different districts, and probably many deaths among both classes are attributed to Hindus. The highest monthly death rates occurred in September, August, October, November and December, the incidence being earlier than usual ; the monthly birth-rates follow generally in the same order. The lowest death-rates occurred in February, March, July and January, and the lowest birth-rates in June, May, July and February.

Among male infants the death-rate was 336·13, and among females 310·10, against 227·74 and 210·46 in 1898 respectively. But the rates calculated on the number of births recorded during the year were 238·83 for boys and 231·14 for girls, or a combined infantile mortality rate of 235·13. The mortality among children between one and five years, which was 44·63 per 1,000 for boys and 44·48 for girls in 1898, rose to 56·21 and 55·01 respectively in 1899. At all the age periods, save 15 to 30 inclusive, males died at a higher rate than females, the average for the former being 33·62 per 1,000, and for the latter 32·73.

Punjab.—The number of births registered in the Punjab in 1899 was 994,001, a birth-rate of 48·4 per 1,000 on the census population of 1891. This rate is the highest recorded either in the Punjab or in any large province of India, save that for the Central Provinces in 1881, when a rate of 48·94 per 1,000 was returned. In 1898 the number of births recorded was 841,869, so that during the year under review there was an increase of 152,132, and a rise in the rate amounting to 7·4 per 1,000 ; and as compared with the quinquennial mean, the rise was 5·5 per 1,000. In the district of Jhang the extraordinary birth-rate of 69·1 per 1,000 was recorded, and this is attributed to the influx of large numbers of people in consequence of the opening of the Chenab Canal Colony ; even when an approximate calculation of the present population of the district is made to include recent immigrants, the birth-rate works out at 61·9. In 12 other districts the birth-rates ranged from 61·2 to 50·3, and this extraordinary record is attributed to the employment of the census population figure of 1891, to the general healthiness of the preceding year, and to improved registration. At the other end of the scale we find four districts only in which the birth-rate was below 40 per 1,000, *viz.*, Simla (21·7), Peshawar (30·4), and Kangra (36·4) and Hazara (36·8). In Simla the low rate is well accounted for by the abnormal sex distribution of the population, and as regards the frontier districts which invariably occupy a low place in the birth tables, there can be no doubt that registration is still defective, for the death-rates are also comparatively low, and the Pathan is recognized as being averse to notifying domestic occurrences.

The percentages of males born to females, which in 1898 was 110·4, fell to 109·6, and ranged from 122·6 in Dera Ghazi Khan to 105·4 in Simla.

The number of deaths registered in 1899 was 607,725 against 638,124 in the previous year, giving death-rates of 29·57 and 31·05 per 1,000 respectively, as compared with the quinquennial mean of 31·9. The highest rates were returned from Jhang (41·6), Karnal (35·3) and Gurgaon (35), and as regards the first, the comparatively high mortality recorded is attributed to prevalence of malarial fever due to irrigation, and to an underestimated population figure on which the ratio is calculated. The lowest death-rates were registered in Montgomery (20·3), Dera Ghazi Khan (21·7), Simla and Hazara (both 22·6) ; the rate recorded for Montgomery is suspiciously low, and the fact that the infantile mortality figure is only 183 against an average of 207 for the province is significant of defective registration, which is also recognized as a factor to be taken into account in considering the low rates recorded in the frontier districts. The average death-rate

returned by rural circles was 29·23 against 32·58 by the towns, in which rates ranged from 44·90 in Kaithal (Karnal), and 44·80 in Muzaffargarh to 12·07 in Kulachi (Dera Ismail Khan) and 13·83 in Abbottabad. The average rate for the principal towns was 34 per 1,000, as in 1898, the lowest figure recorded since 1889, and 5 per 1,000 less than the average of the previous ten years.

Among the various sects by far the highest rate, as usual, was returned against "other classes," *viz.*, 138·45, a very great rise over the figures for the previous year (79·61), but the population did not exceed 6,067 in 1891, and apart from errors due to a probable large increase, of which no account is taken in calculating the ratio, and to erroneous registration, the rate is generally enhanced by the inclusion of 921 deaths from cholera among immigrants from Bikanir, whose religion could not be ascertained. Hindus had a death-rate of 30·72, practically the same as in 1898; the rate for Muhammadans was 28·55 against 31·19 in 1898; and that for Christians 18·23 against 19·54.

The seasonal incidence of mortality presented no exceptional features, the highest death-rates were recorded in December, November and August, and the lowest in April, July, June and February.

Male infants died at the rate of 230·88 per 1,000, and females at the rate of 229·01, compared with 215·19 and 210·09 respectively in 1898. The combined infantile mortality figure, calculated on the births recorded during the year, was 207, and with the wide range from 303·7 in Simla District to 156 in Peshawar District. Children between one and five years died at the rates of 47·97 and 51·27 per 1,000, against 63·04 and 68·57 respectively in 1898. At all age periods, save those of infancy and between 40 and 60 years, the female death-rates were the higher, the averages being 28·49 per 1,000 for males and 30·82 for females; this relation of the mortality of the sexes is quite exceptional, and contrasts notably with the Bengal returns.

Central Provinces.—The main features of the vital statistics of the Central Provinces are the extraordinary birth and death rates when the figures of the last three years are compared. Excluding the Zamindaris, the figures for which have only been reported for the last two years, we find a birth-rate rising from 26·83 per 1,000 in 1897 to 29·91 in 1898 and 47·35 in 1899; a death-rate falling from 69·34 in the first year to 24·3 in the second, and rising again to 28·09 in the third year.

In 1898 the number of births recorded was 284,176, a ratio per 1,000 of 29·91, and the figures rose in 1889 to 449,895 and 47·35 per 1,000 respectively. The extraordinary upward bound exhibited by the monthly rates in September, 1898, was fully maintained throughout the year under review, and reached its acme in April and August, in each of which months over 40,000 births were recorded, equal to an annual rate of over 50 per 1,000 on the census population. It is necessary to go back to 1881, when the birth-rate returned was 48·94, to find a record of fecundity at all approaching that of 1899, which was 11·64 higher than the decennial mean, and taken along with the comparatively low death-rate, one may entertain the hope that the figures indicate a return of prosperity and a remarkable recovery from the effects of the famine of 1897.

As compared with the previous year, the increase has been fairly distributed over all the districts, the highest rates being returned from Burhanpur (60·06), Nimar (58·59) and Chindwara (54·78); and the lowest from Saugor (38·58), Hoshangabad (42·04), Balaghat (42·88) and Narsingpur (43·34). In every district there was an excess of births over deaths, the average excess for the *Khalsa* amounting to 19·26 per 1,000; the rate recorded in rural circles was 47·56 against 44·64 in the municipal towns. The percentage of male to female births was 105·29, and ranged from 111·68 in Murwara to 101·68 in Chhindwara.

The total number of registered deaths which was 230,907 in 1898 (24·30 per 1,000) rose to 266·930, a ratio of 28·09 per 1,000 in 1899, compared with 43·38 the quinquennial mean. Among the districts the highest rates registered were 46·15 in Burhanpur, 45·16 in Nimar, 33·28 in Wardha, and 32·86 in Chhindwara, and the lowest were 23·05 in Bilaspur, 23·17 in Saugor, and 23·91 in Mandla. In the rural areas the average rate was 27·53 per 1,000 as compared with 34·11 in the towns, where the death-rate ranged from 70·28 in Arung (Raipur), 62·50 in Katol (Nagpur), and 59·54 in Arvi (Warda), to 15·92 in Saugor Cantonment, 16·05 in Rajim (Raipur), and 16·29 in Rehli (Saugor).

The seasonal incidence of disease as indicated by the monthly death-rates exhibited a marked variation from the normal; the highest rates were recorded during the first six months, and the mortality curve reached its highest points in April and March, falling thereafter to July, and showing little variation throughout the rest of the year, where it maintained a line considerably below the normal. The Sanitary Commissioner throws no

light on this exceptional seasonal incidence, but it is apparently due to the abnormal mortality from "fevers" in the earlier months, with an exceptional immunity therefrom in the autumn, the latter fact being possibly associated with an abnormally light total rainfall and its early cessation.

The death-rate among Hindus was, as in the previous year, the lowest, viz., 25·46 per 1,000, Muhammadans following with 29·87, while that for "other classes," invariably the highest, was returned at 42·35.

The death-rate among infants, as calculated on the census population, was 416·94 per 1,000 for males and 350·11 for females, or nearly double the figures for 1898; but in a population that has passed through such vicissitudes during the last three years this is eminently a case where it is necessary to take the ratios on the recorded births for the year. In this way the infantile mortality rate for the province works out at 229, ranging from 294·2 in Nimar District to 193·8 in Murwara District. It is a notable fact that four districts, Saugor, Damoh, Murwara, and Nursingpur, have a combined average infantile mortality rate of under 200, moreover in these same areas the urban birth-rate exceeds the rural, both facts pointing to defective registration. Children over one and under five years of age died at the rate of 25·85 and 21·02 per 1,000 respectively, the mortality, so far as it can be judged by the figures, being slightly less than in the previous year. As is invariably the case in the Central Provinces, the male death-rate were higher at every age period, the average being 30·48, and for females 25·71 per 1,000.

Berar.—The number of births registered in Berar in 1898 was 89,414, a rate of 31·3 per 1,000, but in 1899 the enormous number of 144,034 births was registered, giving a rate per 1,000 on the census population of 50·5, the highest on record for the area, and indeed for any Indian province; moreover, it was no less than 14·5 per 1,000 in excess of the quinquennial mean. In the Akola District the rate was 54·3, and in Buldina 53·2 per 1000, while the lowest rates were 45·8 and 48·6 per 1,000 in Basim and Wun respectively. The previous year, judged by the low death-rate recorded (23·4), was exceptionally healthy, and with this was associated an abundant harvest and low prices for staple foods, and doubtless these were important factors in restoring those conditions of vitality on which fecundity depends. But there is reason to believe that the census population figure on which the rates are calculated is considerably below the actual number of the present inhabitants, which, apart from the natural increase, has probably been enhanced by immigration owing to hard times in neighbouring areas. The number of births recorded exceeded the deaths in every district, the largest excess being shown in Buldana, 15·6 per 1,000.

The average percentage of male to female births was 106·4, varying between 108·5 in Ellichpur to 105·4 in Buldana.

The number of deaths showed an equally remarkable rise, viz., from 66,806, or a ratio per 1,000 of 23·4, to 113,992, which is 39·9 per 1,000 on the census population. The registered causes of mortality show an increase under all heads, save that of "small-pox," and the increase was largest in the districts of Akola (25·7) and Ellichpur (21·3). The explanation of this remarkable rise in the death-rate as compared with the previous year is probably to be found in the prevalence of influenza, which was particularly fatal in March, April and May, and which not only accounts for the unusual seasonal incidence of the fever-mortality, but also probably explains the increase (6·8 per 1,000) in the death-rate from "other causes" over that of 1898; the excess of population over that of the census figure, and the extraordinarily high birth-rate were doubtless also factors, the former in rendering the ratio calculation fallacious, and the latter in providing a large number of infants to fall a prey to fatal disease. Akola with 50·8, and Ellichpur with 45·6, returned the highest death-rates; the lowest being attributed to Basim with 35·5, and Wun with 30·9, the latter figure being probably due to defective registration. In rural areas the average death-rate was 39·5, against 42·6 in the towns, in which the extremes registered were 55·8 per 1,000 in Shegaon (Akola) and 28·8 in Sendurjana (Amraoti).

As regards sects the highest death-rate was attributed to "other classes," 44·4 per 1,000; Hindus followed with 40·0, Muhammadans with 36·4, and Christians with 27·1 per 1,000.

Male and female infants died at the rates of 392·5 and 337·1 per 1,000 against 194·8 and 168·8 respectively in the previous year. The combined infantile mortality rate calculated on the births recorded was 231·5 in 1899, but in one district (Wun) the figure returned is only 196·6, which supports the suggestion that registration needs attention. Children between one and five years of age died at the rates of 93·2 and 81·9 per 1,000 respectively, a mortality just twice as high as that recorded in the previous

year. At all the age periods from 10 to 40 inclusive the female death-rates were higher than those of males, but below and above these ages the rates for males showed an excess ; the averages at all ages being, for males 41·0, and for females 38·8 per 1,000.

Madras.—The notable features of the vital statistics of the Madras Presidency in 1899 are, as usual, the extraordinarily low birth and death rates and the wide range of variation not only between the figures recorded for urban and rural centres taken in the sum, but also between those of the different urban and rural centres when compared *inter se.*

The total number of births recorded in 1898 was 911,742, a ratio of 27·4 per 1,000, but the figures rose to 1,048,335 and 31·3 per 1,000 in 1899, giving the highest rate ever recorded, and an advance of 2·7 per 1,000 over that of the quinquennial mean. All but five of the 22 districts share in the increase, the highest rates being 40·5 in Kistna, 40·4 in Madras and 37·2 in Vizagapatam, and the lowest were 22·3 in Madura, 26·0 in Malabar and 26·4 in Nellore. The largest increase as compared with 1898 is found in the districts affected by famine in 1897, but still it is noted that the rates recorded in these were in some cases below their normal average. In rural areas the average birth-rate was 30·9 against 35·7 per 1,000 in the towns, a relation which is exceptional and confined to this Presidency.

The percentage of male to female births was 103·9 against 104·3 in the previous year, and ranged from 107·6 in the Nilgiris to 100·1 in Anantapur.

The total number of deaths registered in 1899 was 675,094, or 24,014 fewer than in the preceding year, and the ratio per 1,000 which had fallen to 21·0 declined still further to 20·1, or 1·2 per 1,000 below the quinquennial average, the decrease being attributable to the diminished prevalence of cholera. The Sanitary Commissioner remarks that "it is hopeless to attempt, under existing circumstances of registration, to criticize the death-rates reported from districts. They may possibly sink to the almost certainly ridiculous rate of 14·4 per 1,000 in Ganjam, or rise to nearly 30 per 1,000 in South Canara, without its being possible to state definitely what are the errors of omission or commission." But it is pointed out that "there is a tendency to ignore the deaths of infants," and this is borne out by an analysis of the infantile mortality rates in different areas. For example, Vizagapatam added 13·4 per 1,000 to its birth-rate (23·8 in 1898 and 37·2 in 1899), and maintained a stationary death-rate (18·5), and yet the infantile mortality figure which was 115·4 in the former year rose merely to 117·9 in 1899 against the provincial average of 159·8. The Malabar district birth-rate rose by 7·4 per 1,000, but the death-rate fell by 2 per 1000, and the infantile mortality figure likewise fell from 101·4 to 96·7. Again, the following figures are instructive :—

——	Urban.	Rural.	Excess of Urban.
Death-rate per 1,000	29·1	19·4	52 per cent.
Infantile mortality	223·9	159·8	40 per cent.

The neglect to register the deaths of infants doubtless accounts for much of the variation in the different death-rates recorded, though town-life is more unhealthy and registration at other age periods more complete in urban circles, which is borne out by the fact that the death-rate from "other causes," which takes the leading place in the mortality figures, was no less than 17·4 per 1,000 in urban and only 9·5 per 1,000 in rural centres.

The local authorities have long recognised the necessity for measures for the improvement of registration, and one important result has been the passing of the "Registration of Births and Deaths Act," 1899, which is to be worked, at first, tentatively in selected rural areas ; this is undoubtedly a very necessary and hopeful measure.

Among the different sects the highest death-rate was registered among "other classes," 23·6 per 1,000 against 14·1 in 1898 ; Hindus followed with 20·3, Muhammadans with 18·6, and Christians with 16·3, showing little variation as compared with the previous year's figures.

The highest monthly death-rate was recorded in January (2·2) with a steady fall through February and March to the lowest figure in April (1·4) ; from May to September there was little variation (1·5 to 1·6) ; and from October came the usual steady rise, from 1·7 to 1·9 in November, and to 2·0 in December.

Male infants died at the rate of 158·0 per 1,000 of the census population at that age, and females at the rate of 131·1 ; the infantile mortality calculated on the births has already been referred to. Children between one and five years of age died at the rates of 24·2 and 22·7 for boys and girls respectively. At all age periods, save those from 10—30 inclusive, males had higher death-rates than females, the average at all periods being 20·7 per 1,000 for the former and 19·5 for the latter.

Coorg.—The feature of chief interest in the vital statistics of Coorg is the relation borne by the births to the deaths ; in all but two years in the last decade the latter have exceeded the former, and the explanation given is that more than one-third of the total population consists of immigrant coolies, who generally come without their families, and who while adding little to the births contribute largely to the death-rate. There can be no doubt that this explanation is correct to a large extent, though it is doubtful if it covers the whole of the deficit which the figures disclose. Under such circumstances, it is clear that the census figures of 1891 are not trustworthy, and the difficulty of arriving at safe conclusions is enhanced by the fact that registration is not compulsory. It has been decided to register henceforth the deaths among the immigrants separately from those of the indigenous population, and if this distinction be extended to the births, we may hope for a notable improvement in the fundamental basis of sanitary reform, especially if the proposal to enforce compulsory registration, now under consideration, be carried out.

The total number of births, which had fallen in 1898 to 2,795, a rate of 16·15 per 1,000, rose to 4,427, or 25·59 per 1,000, in 1899, which amounts to an excess of 2·43 over the average for the quinquennium. The rates in the various districts ranged from 32·53 per 1,000 in Padinalknad and 26·86 in Nanjarajpatna, to 21·07 in Yedenalknad and 22·80 in Mercara ; in only two of the five districts did the number of births exceed that of the deaths. The average birth-rate in the towns was 15·67 compared with 7·67 in 1898.

The percentage of males to females born which was 107·34 in the previous year fell unaccountably to 95·80, ranging from 106·64 in Nanjarajpatna to 86·34 in Yedenalknad.

The number of deaths recorded fell from 8,658 in 1897 to 5,440 in 1898, and still further to 4,845 in 1899, and the death-rate from 50·03 to 31·44 and 28·0 in the three last years respectively ; the rate for 1899 being 4·36 per 1,000 below the previous five years' average. The district death-rates varied from 34·05 per 1,000 in Nanjarajpatna to 20·97 in Kiggatnad, but details are not given which would permit of a discussion of the figures. The average rate in rural circles was 27·24 against 35·65 in the towns. The latter are all very small, and the death-rates in some are largely raised by the inclusion in their statistics of the deaths of immigrant coolies ; of the 218 deaths recorded in Mercara town, 69 occurred in hospital, of which 48 were known to have been among coolies from Mysore ; again in Virajandrapet town, of 220 deaths registered, 127 occurred in hospital, of which no less than 121 were known to have been coolies from Malabar.

Among Hindus, who form the vast majority of the population, the death-rate was 27·54 ; among Muhammadans it was 29·61 ; and among the small number included in "other classes," it was 51·06.

The monthly death-rates were highest in July, June, August and September, and lowest in November and April and February, yielding a fairly average incidence.

The death-rate among infants was 251·42 per 1,000 for males and 223·18 for females ; the infantile mortality figure calculated on the births being 231·3 against 265·4 in the previous year. Among boys and girls of between one and five years of age the rates were 24·40 and 19·30 per 1,000 respectively, showing a considerable decline during the last three years. In the two age periods 10–15 and 20–30 the female death-rates were the higher, and the rates for both sexes were exceptionally high in the periods from 20–50 inclusive, doubtless owing to the mortality among adult immigrants. The average death-rate for males was 28·52 per 1,000 and for females, 27·35.

Bombay.—The number of births registered in the Presidency of Bombay, including Sind, was 685,348 against 582,371 in 1898 ; the rate per 1,000 on the census population is 36·42, compared with only 30·94 in the previous year and a quinquennial average of 34·41. This increase was noted in all the registration districts, but in the collectorates of Broach, Panch Mahals, Thar and Parkar and the City of Bombay there was a falling off as compared with the rates for 1898. The highest district rates were registered in Khandesh, 52·85 per 1,000, Nasik, 49·44, and Ahmednagar, 45·76 ; and the lowest in

Hyderabad and Thar and Parkar, both with rates of 21·51 per 1,000, and Bombay City, 12·88. The Hyderabad and Bombay rates vary little from the average, they are always the lowest, and as regards Thar and Parkar, it is explained that famine and consequent emigration account for a decrease of nearly 7 per 1,000 in the birth-rate as compared with that of 1898. In rural areas the average birth-rate was 37·80 per 1,000, showing a rise of 5·9 per 1,000 over the figure of the previous year; in towns it was only 26·48, but this also was 2·4 per 1,000 higher than in 1898. The urban rates were again much affected in several places by the exodus on account of plague; for instance, the lowest rates are recorded for Poona, 8·10 per 1,000; for Belgaum, 11·85; and Bombay, 12·88; and these were all affected by plague. The highest rates are returned from Vengurla 73·32; Borsad, also highest in 1898, 64·97; and Nandurbar 63·23; 21 out of the total of 56 towns record a birth-rate above 40 per 1,000.

The percentage of male to female births was 108·01, slightly lower than that of recent years, and it varied from 133·25 in Hyderabad (and this is a feature of the figures from Sind as a whole) to 102·75 in Dharwar.

The total number of deaths registered was 672,269, or 123,444 more than in the previous year, and the death-rate on the census population rose from 29·16 in 1898 to 35·72 in 1899, as compared with the quinquennial average of 32·31. Nearly two-thirds of the increase, as compared with the previous year, is attributed to an enormous rise in the death-rate from "other causes," from which there were 78,537 more deaths than in 1898; no less than 29,826 deaths under this heading are recorded in Bombay City alone, giving a death-rate of 37 per 1,000. The increase has been very marked from 1897 onwards, and since 1896 the deaths thus registered have increased to the extent of over 250 per cent. The Sanitary Commissioner attributes this striking feature of the returns to improved registration, and certainly the number of deaths returned under the inclusive term "fevers" has fallen off during the last two years to an extent approximately equal to the rise in the number under "other causes." To plague 96,596 death are attributed against 86,191 in the previous year, a ratio per 1,000 of 5·13 as compared with 4·58 in 1898. The highest district death-rates were 69·54, 49·67 and 49·62 in the City of Bombay, Poona and Nasik respectively, where plague was prevalent; the lowest rates were 17·48, 16·97 and 13·87 in Shikarpur, Upper Sind Frontier and Hyderabad, all in Sind, where registration is defective.

In rural areas the average death-rate was 31·76 per 1,000 against 64·10 in the towns, both showing a considerable rise over the figures of 1898. Among the latter the highest rates were returned by Umarkot, 228·77, Nasik, 153·77, and Poona, 128·02. In the first case the enormous mortality is ascribed to fever affecting a population whose natural resistance was impaired by privation; in the two latter cases plague was the chief cause.

Christians and Hindus died at the rates of 38·66 and 38·12 per 1,000 respectively; the death-rate for Parsis being 32·06, and that for Muhammadans 25·98; while "other classes" exhibited, as usual, the lowest mortality, viz., 12·74 per 1,000.

As regards the seasonal incidence of mortality, it was decidedly higher in the first four and last five months of the year than in in May, June and July, when, as usual, it was at its lowest.

Male infants died at the rate of 212·15 per 1,000 and females at the rate of 181·80, as calculated on the obsolete census population, the corresponding provincial infantile mortality rates per 1,000 of births are 202·71 and 187·86 respectively, and in the City of Bombay we find the enormous rate of 798·69 recorded, a plain indication of a most lamentable condition of the public health. Children between the ages of 1 and 5 years had death-rates of 49·15 per 1,000 for boys and 46·80 for girls. The mortality among females was higher than that of males in the 5 to 20 age periods inclusive, the average rates at all ages being 36·48 for males and 34·90 for females.

Burma.—As explained in this report for 1898, a slight reduction was made in the population referred to in the registration returns of Lower Burma, by the exclusion of certain inaccessible tracts which are patrolled only at somewhat irregular intervals. This re-arrangement has been carried still further, and in consequence the total population figure which stood at 4,510,697 has been reduced for vital statistical purposes to 4,461,027. The aggregate population of these excluded tracts amounts to 64,599, and during the year 1899 the birth and death rates recorded among them were 35·99 and 24·78 per 1,000 respectively, figures which exhibit a great advance on those of the previous year, but as the area and population have been largely increased no fair comparison is possible. In Lower Burma the total number of births recorded in 1899 was 165,229, a ratio of 37·04 per 1,000 as compared with 153,838 and 34·11 per 1,000 respectively in the

previous year, which had also shown a similar increase over the record for 1897; the excess over the decennial average rate amounts to fully 10 per 1,000, and we have here another instance of the highest birth-rate on record, a result to which the attention recently given to registration has largely contributed. Still, much remains to be done as is evident when the variation in the rates is taken into account. We find among the districts, Pegu with 46·08 per 1,000, Myaungmya with 44·81 and Henzanda with 43·99, while Rangoon returns 17·55 per 1,000, Hanthawaddy 31·36 and Akyab 32·18. This disparity is even more marked in the towns, and after excluding Rangoon (17·55) and Akyab (16·40), where the great disproportion of the sexes may be held to be largely accountable for their low rates, we find the figures ranged from 56·83 in Kawkareik and 45·73 in Myanaung to 16·90 in Yandaon and 21·14 in Kyaukpyu, yielding an average of 26·09, or fully 12·58 per 1,000 below the average recorded in rural circles.

The percentage of male to female births was 108, ranging from 114 in Toungoo to 101 in Thayetmyo.

The number of deaths registered was 121,771 and the death-rate was 27·30 per 1,000 as compared with 26·13 in 1898 and 24·40 the mean of the previous five years. The Irrawaddy division which returned the highest birth-rate yielded also the highest death-rate (29·12), and similarly the lowest death-rate (22·57) was recorded in the Minbu division, in which the birth-rate was lowest. The district rates varied between 44·03 in Rangoon and 32·57 in Pegu to 20·55 in Akyab and 22·47 in Prome; the average for rural circles being 26·23 against 34·46 in the towns, among which the highest rates were 59·09 in Kawkereik and 53·60 in Myaungmya, and the lowest 15·44 in Paungde and 18·96 in Sandoway. Where the rates were highest cholera and small-pox were unusually prevalent; 4,942 deaths were recorded from the former disease in Lower Burma during the year, only one district being free from the disease, but the fact that the case mortality is returned at 95·31 per cent. makes it clear that probably nearly half the cases were unrecorded. Under such circumstances the difficulties attending the task of marking down the factors of causation and of importation of the disease are rendered well nigh insuperable.

Among the different sects, the highest death-rate was registered among Hindus, 37·50, due chiefly to the excessive mortality among the immigrant population of Rangoon, where the rate reached the high figure of 54·84, and although these outlanders live under far more insanitary conditions than the indigenous Buddhists, it is propable that the census population figure is far from accurate. For "other classes," who number some 94,000 souls, the rate was 31·11 per 1,000, but here again the census figure is doubtless defective. The Buddhists forming the bulk of the people had a death-rate of 27·94, followed by the Muhammadans with 22·09 and the Christians with 17·45 per 1,000.

The highest numbers of deaths were recorded in July, August and June, and the lowest in January, February and March, an incidence which may be taken as fairly normal.

Among male infants the death-rate was 294·49 per thousand living, as compared with 212·77 among females. The true infantile mortality rate for both sexes works out at 185 per 1,000, ranging from 357 in Rangoon to 102 in Tavoy. The average for the whole Tenasserim division is only 145 against 204 for the Pegu division, and these facts have an important bearing on the completeness of registration in the respective areas.

Boys and girls between one and five years of age died, respectively, at the rates of 38·93 and 32·44 per 1,000. At all age periods, save 30–40 when the female rate slightly exceeded that of the male, the male death-rates were the higher, the average being 29·04 per 1,000 among males and 25·34 among females.

In Upper Burma registration in 1899 was extended to 13 towns as compared with nine only in the previous year, and for the first time vital statistical records were instituted in the rural areas. For the present, the returns are kept separate from those of Lower Burma, but following on the census of 1901, it is intended to consolidate the whole of the statistics for the combined province.

The total population (census of 1891) on which the death-rates are based is 2,454,288, of which the vast majority, 97 per cent., are Burmese, but, for the present, birth registration is confined to the 13 towns, with an aggregate population of 311,605. It is clear that in a progressive area open to immigration an enumeration carried out nine years ago must be a defective basis for calculation; moreover, the first attempts at registration will naturally possess an approximate value only. But after making all allowances, the figures must be considered extremely good and encouraging.

The total number of births recorded in the towns was 10,484, or 33·65 per 1,000, as compared with 37·04 for Lower Burma as a whole, or more reasonably with 26·09, the

urban rate in the contiguous area. Pyinmana recorded a rate of 41·78 per 1,000, and Yamethin of 41·46, while Minbu returned only 4·81, and Pagan 10·54, rates due undoubtedly to faulty registration which time and use will improve. The percentage of male to female births ranged from 123 to 88.

The deaths were recorded for the total population, urban and rural, and numbered 51,615, giving a ratio per 1,000 of 21·03. The districts recording the highest rates were Kyaukse, 32·83, and Mandalay, 31·86, per 1,000, as compared with the lowest rates in Magwe, 12·91, and Myingyan, 14·13. The death-rate in rural areas was 18·98 as against 35·15 in the towns, among which the highest rates were 54·62 in Monywa and 42·55 in Pyinmana, and the lowest were 19·26 in Minbu and 21·39 in Kyaukse. But the average urban death-rate in Upper Burma, 35·15 per 1,000, is notable chiefly as exceeding that of Lower Burma, 34·46 per 1,000 ; there were fewer deaths from small-pox, dysentery, and diarrhœa and injuries, but many more from "other causes," in the former as compared with the latter.

The figures have a special interest as demonstrating the characters that may be looked for in vital statistics in areas where registration is undoubtedly and admitted defective, and so, of affording indications for test and comparison with the returns received from areas from which a far higher standard may reasonably be expected.

History of Chief Diseases.

Cholera.

It is the custom to epitomize in this place any facts bearing on the etiology of cholera which observation and research have brought to light during the past twelve months. Once more it must be admitted that there is no epoch-marking advance to chronicle; at the same time everything is of importance that serves to elucidate, in however small degree, any single point in a fascinating epidemiological problem.

"*Comma*" *Organisms in Drinking-water.*—Some observations made by M. Haffkine, Director-in-Chief of the Plague Research Laboratory, Parel, Bombay, in collaboration with Captain Lamb, I.M.S., have an interesting bearing on the question of the relation of infected water-supplies to cholera outbreaks. Advantage was taken of the prevalence of cholera in the famine areas of Gujarat during the months of April and May, 1900, to make a bacteriological study of a series of 33 drinking-water samples taken in 14 localities where the disease was either actually present or had only recently subsided. When collecting the specimens, Captain Lamb noted carefully all particulars as to the locality and source, and the conditions as to the prevalence of cholera ; at the same time he prepared microscopic specimens and cultures, which he merely numbered and sent to the Laboratory at Bombay for examination ; this latter part of the work was thus done independently of the officer who had a knowledge of the origin of the specimens.

Of the 33 samples examined, "curved bacteria, belonging to the class of comma-shaped bacilli," occurred in the microscopic specimens obtained from ten ; in four of these ten the baccilli were isolated in pure culture and submitted to further study. One of these latter answered in every respect to all the typical tests of the cholera "comma bacillus." A second corresponded thereto in many essential points, but differed in two important characters ; while the remaining two, though morphologically classed as "commas," differed markedly from typical cholera microbes.

Notwithstanding the above variation, the following correspondence between the presence or absence of comma-shaped organisms and the prevalence or otherwise of cholera was found. Comma curved baccilli were found in the samples taken from eight of the 14 localities ; they were absent from the remaining six. In seven of the eight localities cases of cholera were still occurring either daily or at brief intervals, and in one place only there had been no cases for 39 days before the samples were taken, but it was subsequently reported on good authority that a recrudescence of the disease had occurred here "shortly after." On the other hand, in five of the six places in the water from which no "commas" were detected in the Laboratory, Captain Lamb's notes show that there was no cholera ; while in the sixth place "sporadic cases" were noted. In all, 278 specimens were examined in arriving at this independent confirmation of the information obtained locally, and the correspondence, whatever its real value, is worthy of note, all the more so as it confirms a similar result arrived at in the exhaustive survey of the water-supplies of

211 localities in Calcutta undertaken by M. Haffkine in the cholera season of 1894. Specimens from 110 "tanks" were then examined, and of these—

(*a*) 46 were tanks round which cholera existed at the time ;
(*b*) 5 were tanks round which cholera had existed from four to six weeks previously, but had since disappeared ;
(*c*) 59 were tanks round which the disease had not appeared at all during the four months of that year.

Out of 46 in category (*a*) comma-shaped bacilli were found in 42, *i.e.*, 91·3 per cent., out of the five in (*b*) these organisms were found in none, and of the 59 in (*c*) "commas" were found in 11 only, *i.e.*, in 18·8 per cent., and were not found in 44, or 81·4 per cent.

The vibrios found in the Gujarat and Calcutta waters varied greatly in their detailed characters, and it is probable that only a small proportion of the whole were true cholera "commas" ; but it is suggested that the prevalence of this morphological type in places where cholera exists, and their relative absence from places free from the disease, can be best interpreted by the supposition that the whole class, including the typical cholera "commas," require for their existence similar or very comparable conditions ; on the one hand, when these conditions are inimical to the cholera bacilli, no vibrios of any kind are to be met with ; and on the other hand, when conditions favour the growth of curved bacilli in general, the typical cholera organism develops and propagates in large numbers, and possibly causes an outbreak of the disease.

It would have added to the interest of these observations if the different vibrios isolated had been tested by Pfeiffer's reaction. Mr. Hankin, who has devoted much study to the subject of the micro-organic flora of water-supplies in connection with cholera outbreaks, has made some experiments on this point. Starting with the assumption that the microbes isolated from patients suffering from the disease will give the agglutination reaction with the serum of an immunised animal, it does not follow that cholera-vibrios found as saprophytes in the endemic area should similarly react to the specific test. Such vibrios may have existed for an indefinite number of generations in water or mud, and have never been in contact with the tissues of a susceptible animal. In an outbreak at Bombay he therefore took the opportunity of putting this question to the test. He isolated over twenty vibrios from the pipe-water, and about twenty more from the well-water and mud in an area where cholera was prevalent, and he found that the vibrios from water, with one exception, did not react with Pfeiffer's test ; the vibrios from mud reacted clearly but slowly, whereas those from patients' dejecta reacted instantly and strongly so as to produce a dense clot from the emulsion. These experiments were repeated subsequently in an outbreak near Agra, the microbes being isolated from a well, the supposed source of the epidemic, in which a woman suffering from "diarrhœa" had committed suicide. A large proportion of the vibrios gave a most marked reaction with Pfeiffer's test, but subsequent to successive cultivations on Agar-Agar, the test serum lost all agglutinating power upon them. Hence this supposed distinctive character of the vibrio, originally present to a marked degree, was lost after a few days' existence on Agar-Agar, but at the same time the original microbes, not submitted to Agar, still gave the reaction. It would be outside the scope of this report to suggest the consideration to which these facts give rise ; they are sufficiently obvious as bearing on the established facts of variation with the environment, which, when taken into account with the variation of the natural intrinsic predisposition of the human organism, afford the key to many of the epidemiological problems presented by the disease.

M. Haffkine's note concludes with a brief synopsis of the results of the bacterioscopic examination of the water from wells, situated in the same area, and which had been treated with permanganate of potassium. Of 25 wells of which it is reported that they had been treated with the salt, some more and others less frequently, but all within a few days of the date the samples were taken, eight were found to contain "commas" ; one of these latter, a well treated every second day, had true "cholera bacilli." The remaining 17 wells were free from "commas," and in one well that had not been treated, "commas" were found in large numbers. He is careful to add that "these data alone . . . do not permit of any definite conclusion as to the efficacy or otherwise of the permanganate process of treating infected waters."

Every exact observation of the kind has a definite value, however far from conclusive ; theories must be tested by an appeal to facts on each definite issue ; at the same time the careful study of the broad epidemiological facts of outbreaks must be sedulously pursued with less of an agnostic tendency to label them capricious and baffling. An instructive note by the Sanitary Commissioner of Madras offers a good example of the

promising methods of observation that might be profitably pursued more generally. In connexion with the question as to why, when cholera prevailed in every district in his province, only 10 per cent. of the total number of villages was attacked, it being suggested that "there is propably little distinguishable difference between those that suffered and those that escaped," he demurs to the implied premiss that the causative agent is capable of being present in equal potency and under equally favouring circumstances over the large area of the presidency with its different geographical and climatological features. The important factors of human inter-communication, of lines of traffic, of the habits of the people as regards their water-supplies, and the nature of these supplies, all go to make up "sanitary conditions" which vary vastly in their incidence and in their resultant effects in different areas. As regards the water-supply factor, it is obvious that a community that depends on one open surface "tank" must be altogether in a different position towards a water-borne disease than one which possesses a large number of deep wells. And further he gives striking illustrations of the distinctly characteristic incidence of the disease in its epidemic form, in an area watered by a river and dotted with villages at greater or less proximity to its banks. One is struck by the fact that whilst the villages along the banks are almost invariably affected, those more distant on either side escape in a fairly direct ratio with the distance, provided their water-supplies are self-contained and not drawn from the stream; at the same time, a distinct relation is to be traced between disease incidence and local lines of communication. In one instance "for every ten villages within five miles of either bank of the river, 1·34 were affected against 0·24 in every 10 beyond that distance." Moreover, if the affected villages be picked out in colour on a map, "a curious fan-like aspect of attacked localities is exhibited, a result that would seem to imply a contamination of the main stream and the distribution of the virus by the irrigation channels as one approaches the coast." Further observations in support of this view are given in the provincial records in this section, where also attention is directed to the characteristic and very definite contrast in the seasonal incidence of the disease from year to year in the two main geographical and climatological areas into which the Madras Presidency is naturally divided. Much confusion and apparent caprice in the incidence of the disease in time and place has arisen from a consideration of the returns from whole provincial areas, but if the natural integral areas be studied separately, in the light of a knowledge of local conditions, each is found to present a definite and characteristic epidemiological picture. It would overburden this report, which is restricted to a brief resumé of the history of cholera during the past year, to adduce examples in support of the contention that in the sense of an ordered sequence of events a "law" may reasonably be adumbrated, if we may not define or explain its action, for the disease prevails under certain definite conditions peculiar in the sum to each locality, though doubtless in a measure common to all. It is merely to emphasize the necessity of research and observation on the opposite but contributory lines indicated that these few remarks are made.

Anti-cholera Inoculations.—The experiments in cholera prophylaxis were continued at the Purulia and Salkea coolie-depôts in Bengal, the total number of inoculations performed during the year being 2,388, the figures for the two preceding years having been 4,296 and 10,950 respectively. The falling off is attributed to the fact that cholera being less prevalent in the coolie track, the urgent inducement was wanting, and some agents preferred not to incur the small pecuniary loss the operation involves, though it is said that all agents are convinced of its value, and that a few insist upon its performance. That the downward tendency exhibited by the figures given above is merely temporary is well shown by the fact that during the first four months of 1900, no less than 8,423 inoculations had been performed. As regards the results, the Labour Immigration Report (Assam, 1899) shows that while the death-rate on the uninoculated during transit to the gardens was 0·294, there was no death among the 2,246 inoculated coolies. Returns were received from only four gardens having aggregate totals of 1,161 uninoculated and 346 inoculated on the staff; there were 36 cases of cholera among the former and 17 among the latter, while the deaths among the two classes were 12 and 10 respectively; this gives a case percentage of 3·1 among the uninoculated, against 4·9 among the inoculated, while the case mortality was 33·3 per cent. among the former and 58·8 per cent. among the latter. It is to be noted, however, that eight of the ten deaths among the inoculated occurred over two years subsequent to the operation, and in any case the figures are too meagre to justify definite conclusions.

Dr. Powell, in a report on all the cases of cholera that have occurred on the estates and in the villages in his practice since the commencement of the prophylaxis experiment, sums up the results as follows:—"There have been 198 cases with 124 deaths among

6,549 persons not inoculated, compared with 27 cases and 14 deaths among 5,778 inoculated individuals. Had the incidence been the same in both classes, the inoculated would have had 174 instead of 27 cases, and 109 deaths instead of 14; the mortality therefore among the non-inoculated was nearly eight times greater than among those inoculated."

I may mention that in view of the prevalence of famine during the early months of the current year, I put forward a proposal that a skilled officer should be deputed to visit the famine camps for the purpose of giving to all willing to receive it the benefit of M. Haffkine's process, as the circumstances appeared to offer an excellent opportunity of obtaining valuable evidence of its practical utility, the harmlessness of the operation, at least, having been definitely established. It was to be clearly understood that no compulsion should be attempted. The Government of India were, however, of opinion that the people, forced by privation to the camps, would not appreciate the entire freedom of choice, which it is of course essential to preserve in this matter, and the great force in the objections raised to the proposal outweighed in my opinion the probable benefits that might have accrued. As it has unhappily proved, cholera has in certain areas added greatly to the horrors of famine, and increased the difficulties of the successful working of the relief camps.

The Distribution of Cholera in India, 1899.—In last year's report the cholera mortality in 1898 was shown to be the smallest on record for 18 years. The number of deaths fell to 152,703, giving an average ratio per 1,000 for the whole country under registration of ·70 only. Again in 1899 the disease was far less prevalent than usual; there were altogether 171,410 deaths returned, a figure which is considerably less than that recorded in an average year in Bengal alone, and the ratio on the census population did not amount to more than ·78 per 1,000, as compared with a quinquennial mean of 1·84. Of the total mortality, Bengal alone accounted for fully 62 per cent., but even here the death-rate from this cause was only two-thirds of the average of the past five years; and it is only in the Punjab, where 1,816 deaths were recorded, that we find the quinquennial mean slightly exceeded. Central India, Hyderabad State and Coorg were entirely free from the disease in a fatal form; Ajmer-Merwara returned only one death and the Central Provinces only 76 deaths.

The statement annexed shows the total numbers of deaths attributed to cholera in every province in India in each year from 1877 onwards:—

Statement showing the deaths from Cholera in the different Provinces in India from 1877 to 1899.

YEAR.	Bengal.*	Assam.	N.-W. P. and Oudh.	Punjab.	Central Provinces.	Berar.	Rajputana.	Central India.	Bombay.	Hyderabad.	Madras.	Mysore.	Coorg.	Lower Burma.	Ajmer-Merwara.
1877	155,305	11,307	31,770	29	3,418	842	60	926	57,228	7,414	357,430	2,902	†	7,276	11
1878	95,192	6,732	22,221	215	40,985	34,306	2,393	8,047	46,743	6,696	47,167	723	49	6,759	210
1879	130,363	17,415	35,892	26,135	27,575	223	918	2,734	6,937	6	13,296	14	—	1,828	120
1880	39,643	2,803	71,546	274	330	1	—	299	684	—	613	25	—	2,638	3
1881	79,180	5,010	25,865	5,207	9,140	3,404	197	581	16,694	1,721	9,446	25	3	5,239	16
1882	182,352	21,055	89,372	39	11,932	3,573	1,327	1,562	7,904	150	23,604	893	31	7,177	289
1883	90,439	14,908	48,160	190	16,235	27,897	797	1,740	37,954	1,947	36,284	124	—	2,185	87
1884	134,421	22,276	30,143	614	149	87	1,297	1,018	13,804	2,479	75,476	330	—	5,515	227
1885	173,767	7,753	63,457	1,936	21,868	3,683	1,615	4,624	37,287	1,387	58,109	2,677	—	7,685	100
1886	118,368	20,188	34,565	12	16,679	976	173	290	167	499	12,417	10	—	4,027	765
1887	172,572	7,941	200,628	8,804	13,576	14,396	2,612	8,868	25,711	2,831	28,359	832	3	2,649	384
1888	111,391	9,693	18,704	14,938	921	305	32	191	36,500	2,057	58,677	1,015	2	15,982	13
1889	171,103	18,288	48,494	2,838	52,588	10,925	6,923	3,344	32,431	1,128	76,020	1,590	9	3,240	55
1890	145,885	15,396	80,295	3,401	4,787	847	2,746	3,132	3,259	—	35,288	1,326	5	1,076	408
1891	229,575	23,882	169,013	10,107	21,312	7,958	2,946	13,474	17,850	3,102	98,773	1,204	7	2,400	532
1892	259,398	21,552	194,886	75,959	39,972	2,030	26,760	8,384	42,900	53	79,033	5,497	58	6,208	2,352
1893	126,976	21,849	12,154	639	557	1,188	314	127	18,853	165	32,209	680	9	2,393	3
1894	236,150	13,497	178,079	113	7,043	3,452	2	5,210	33,588	1,862	42,289	328	8	7,428	—
1895	177,087	18,962	51,562	549	15,506	11,919	1,049	6,043	8,890	467	21,172	2,334	—	5,150	280
1896	226,824	17,042	69,147	5,146	52,985	12,264	3,797	15,766	35,404	525	47,847	2,100	49	2,959	12
1897	196,247	33,240	44,208	622	57,131	10,122	1,496	13,202	57,109	1,039	143,445	4,248	106	8,538	19
1898	65,020	11,149	2,508	‡33	§7	—	6	2	4,368	6	65,444	1,193	8	2,972	1
1899	107,678	8,380	8,142	1,816	§76	541	497	—	8,579	—	20,082	123	—	4,492	1

* Excluding Calcutta from 1877 to 1892.
† Statistics not available.
‡ Including 30 deaths in Cantonments.
§ Excluding Zamindaries.

The next table exhibits the seasonal incidence of the disease, and the most notable feature in this respect is the exceptional mortality falling in the last quarter of the year. But, as already explained, the figures for each provincial area must be studied separately, and further than this, a reference to the local sanitary reports, in order to distinguish the true geographical and climatological groups, will alone afford a true picture of the characteristic incidence of the disease in time and place.

Statement showing the Deaths from Cholera registered in the different Provinces by Months during the year 1899.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1899.	1898.
Bengal	5,344	2,964	4,660	8,433	5,369	2,099	6,542	5,792	6,159	15,807	23,382	20,627	107,678	1·51	0·91
Assam..	368	310	387	383	583	249	131	157	290	640	2,516	2,333	8,380	1·66	2·22
North-Western Provinces and Oudh.	27	13	68	246	428	767	451	1,650	1,212	1,301	1,245	734	8,142	0·17	0·05
Punjab	—	—	—	2	1	1	71	433	89	131	182	906	1,816	0·09	0·002
Central Provinces*	—	—	—	1	—	—	—	—	—	1	10	64	76	0·01	—
Berar	—	—	—	—	—	—	—	5	102	294	105	35	541	0·2	—
Lower Burma ..	89	161	539	920	598	495	510	563	267	358	290	152	4,942	1·11	0·66
Upper Burma ..	—	—	9	179	171	370	268	258	204	230	153	208	2,050	0·84	—
Madras Presidency	11,597	5,876	2,620	2,061	1,665	682	633	422	477	671	893	1,485	29,082	0·9	2·0
Bombay Presidency	23	548	1,568	1,980	2,199	911	478	329	198	284	33	28	8,579	0·46	0·23
Ajmer-Merwara ..	—	—	—	—	—	1	—	—	—	—	—	—	1	0·002	0·01
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0·05
Mysore	63	24	—	9	6	15	3	1	—	1	—	1	123	0·03	0·25
TOTAL ..	17,511	9,896	9,851	14,214	11,023	5,590	9,117	9,610	8,998	19,718	29,309	26,573	171,410	0·78	0·70

* Excluding Zamindaries.

In the next statement the millesimal death-rates from cholera in the various provinces are contrasted with each other, and with the quinquennial averages; urban and rural mortality are compared; the percentages of villages attacked in each province are shown; the highest mortality in any single district and in any single town is set forth; and the month of maximum prevalence in each province is stated:—

PROVINCE.	Mortality in 1899.	Mean mortality of previous five years.	Urban mortality.	Rural mortality.	Per cent. of villages attacked.	Maximum mortality in any one district, excluding towns.	Maximum mortality in any one town.	Month of maximum prevalence.
Bengal	1·51	2·53	2·17	1·48	7·67	6·31	33·34	November.
Assam	1·66	3·75	1·71	1·66	7·16	5·08	12·47	November.
North-Western Provinces and Oudh.	0·17	1·47	0·18	0·17	0·98	1·61	4·55	August.
Punjab	0·09	0·06	0·08	0·09	0·33	1·57	2·53	December.
Central Provinces*	0·01	2·79	—	0·01	0·07	0·33	0·01	December.
Berar	0·2	2·6	0·2	0·2	1·08	1·1	4·4	October.
Lower Burma ...	1·11	1·20	1·79	1·01	6·52	2·14	17·95	April.
Upper „ ...	0·84	—	1·17	0·79	4·70	3·01	21·06	June.
Madras	0·9	2·0	1·5	0·8	7·65	2·6	18·7	January.
Bombay	0·46	1·48	1·09	0·37	1·83	4·53	21·28	May.
Ajmer-Merwara ...	0·002	0·12	—	0·02	0·14	0·00	—	June.

* Excluding Zamindaries.

Cholera in Bengal.—In Bengal in 1899 the number of deaths registered as due to cholera was 107,678, or 1·58 per 1,000 of the population, against 65,020, or a ratio of 0·91 per 1,000 in the previous year, the average for the previous 10 years being 2·59. No district was entirely exempt from the disease in the year under review; it was reported from 17,217 villages, or 7·67 per cent. of the whole number, against 11,307 in 1898, and it prevailed epidemically in 42 registration circles, 90 circles being exempt, as against 130 in 1898.

The highest district death-rates were 6·28 per 1,000 in Malda, 4·59 in Puri, 4·45 in Bogra, and 3·29 in Cuttack, the mortality being greater in 31 districts, and somewhat less in 14, than it was in 1898, a year of exceptional low prevalence.

In Malda the disease existed in a sporadic form during the first eight months of the year, but suddenly assumed epidemic proportions in September, and so continued to prevail throughout the rest of the year, the maximum being reached in November, when 2,742 deaths were recorded. The thanas most affected were those situated on the Ganges and between this river and the Mahanandi, and it is recorded that following on the terrible cyclone that blew over Bhagalpur in October, dead bodies were discovered floating down the Ganges to be subsequently stranded in the *churs* all along the western border of the district. The epidemic also spread inland from the eastern bank of the river, but stopped short of the banks of the Mahanandi.

The high death-rate in Puri was chiefly due to a severe outbreak among the large body of pilgrims congregated there during the last Rath Jatra festival in July. Most of these pilgrims came from Calcutta, the trains bringing large numbers daily to Bhadrak which the steamers from there were unable to cope with, the result being an accumulation of exhausted travellers upon the return roads, and especially in Bhadrak itself, "where there was no provision of food and shelter, and where the water is probably highly polluted." A very large proportion of the devotees were widows who left their homes surreptitiously without adequate provisions, and no factor favourable to an outbreak of the disease was wanting: starvation, bad indigestible food, such as travellers perforce must depend on, polluted water, overcrowding, and all the consequences of no proper accommodation for the undeniable calls of nature. A special report on the subject has been submitted and is under consideration by the Local Government. In Bogra and many other districts the special intensity of the local epidemics was attributed to "the early cessation of the rains and the consequent pollution of the water-supply," the Sanitary Commissioner being of opinion that the usual scouring and cleansing effect of heavy rainfall on open water sources was wanting.

In the rural areas the average death-rate was 1·48 per 1,000 as compared with 2·17 in the towns; of a total of 152 of the latter, the record of 23 is entirely free from a fatal case, and 20 other towns returned only one or two fatalities. Puri town with 960 deaths has a mortality ratio from this one cause of 33·34 per 1,030, but, as previously explained, the deaths occurred chiefly amongst pilgrims; the mortality was also exceptionally high in Muktagachha, 9·14 per 1,000, in Muzaffarpur, 9·08, in Colgang, 7·7, and in Darbhanga, 6·53.

The seasonal incidence of the disease presents the unusual feature of an excessive prevalence during the months of October to December in Bengal Proper and Bihar, whereas it is commonly associated with the hotter and drier months of April and May. Orissa suffered most in July, August, October and September, with a minimum in January, March and February. It is noticeable that while the disease was at its worst in Orissa during the height of the rains it was at its lowest ebb, as usual, in Bengal Proper. Chota Nagpur, as is so frequently the case, was almost free throughout the year, the mortality never being in excess of ·03 per 1,000 in any one month, and this highest point was reached in June.

There were nine admissions to hospital for cholera from among the European seamen of the port of Calcutta during 1899, all of which proved fatal, equal to death-rate calculated on the average strength of 7·50 per 1,000 against 1·62 in 1898. Among the native floating population of the port there were 36 deaths in 1899 against 49 in the previous year, giving ratios per 1,000 of 1·40 and 1·91 respectively on the estimated population.

Assam.—The number of deaths attributed to cholera in Assam was 8,380, equal to a death-rate of 1·66 per 1,000, as compared with 2·22 in 1898 and 3·75 the average for the previous five years; indeed not since 1887, when the number of deaths was 7,941 (1·75), do we find a mortality figure so low as the one now recorded. The actual incidence in the different geographical areas, that is to say, in the two great valleys, did not vary

materially, and the chief feature of the seasonal incidence was the rise in the number of deaths reported in October and the culmination in November and December, in which two months fully half the total deaths occurred. The mortality during the rest of the year was, as regards the Surma Valley, most marked in the first four months, and in the Brahmaputra Valley in the April–July period, a relative seasonal incidence that has been frequently noted in previous years.

The only district in which a notable increase occurred as compared with the previous year was Goalpara, which reported 2,284 deaths, or a ratio per 1,000 of 5·05, against 1·86 in 1898. Kamrup comes next with 2·08 per 1,000, and is followed by Darrang and the Garo Hills, each with 1·70; the lowest rates were 0·56 per 1,000 in the Naga Hills district, and 0·39 in the Khasi and Jaintia Hills, accounted for by one and 19 deaths respectively; elsewhere the rates ranged between 0·64 and 1·37 per 1,000.

As regards Goalpara, it is noted that an outbreak in the *sadr* town and district of Dhubri, lasting from October to December, occasioned just one-half of the total number of deaths registered; "it apparently originated in the river-side depôts amongst batches of tea-garden coolies from whom it spread." However introduced, if introduced, and there is a discrepancy in testimony borne on the subject by the Sanitary Commissioner and the Local Government, the disease claimed only 21 victims among the 24,449 immigrant coolies during their passage up the Brahmaputra, and only 51 more deaths occurred among them while at the depôts; figures which are even lower than those of 1898, and insignificant in comparison with previous years, and which afford satisfactory evidence of the results of the greater care now exercised in all matters affecting the physical welfare of the immigrants throughout their journey.

The population of the tea gardens is given as 636,208 in the Labour Immigration report for the year, and 999 deaths from cholera were recorded among this number, giving a mortality rate of 1·57 per 1,000, a figure which compares most favourably with that of any recent year, and which, indeed, is scarcely higher than that for the free population living in the same areas, viz., 1·33 per 1,000.

In the province generally the average death-rate in rural areas was 1·66 per 1,000, against 1·71 in the towns. Among the latter there were eight out of a total of 23, in which no death occurred, and in four others there was only one fatality recorded in each. The only considerable mortality was in Tezpur, Gauhati and Dhubri, which, with 50, 45, and 31 deaths respectively, furnished death-rates of 12·47, 5·43 and 6·42 per 1,000 in each case.

North-Western Provinces and Oudh.—There were altogether 8,142 deaths attributed to cholera in these provinces during 1899, a ratio per 1,000 of 0·17, as compared with 0·05 in the previous year, and 1·47 the mean of the antecedent quinquennium; excluding the phenomenal record of 1898, the rate for the year under review is by far the lowest hitherto returned. Four of the 48 districts appear to have escaped altogether, and in no less than 11 others less than 10 deaths are recorded in each. Only 0·98 per cent. of the total number of villages over this large area were attacked, and these yielded 7,563 deaths, a rural mortality rate of 0·17 per 1,000; while of the 99 towns, 62 recorded no fatal case, the remaining 37 returning 579 deaths, and giving a rate per 1,000 on the population of the whole of 0·18.

Among the larger towns, Ghazipur had the highest rate from this cause, viz., 1·67 (75 deaths), followed by Fyzabad-Ajudhia with 1·35 (98 deaths); of the smaller towns, Chunar comes first with 4·55 per 1,000 (52 deaths), and next to this, Nagina, 2·84 (63 deaths); in only two other towns did the rate reach 1 per 1,000.

The maximum prevalence of the disease occurred as usual in August, with a fairly maintained incidence till November; the minimum, 13 deaths, was recorded in February.

Punjab.—Following on a year of almost total immunity from the disease, there were 1,816 deaths recorded in the Punjab in 1899, a larger number than in any year since 1892, save 1896, the year of the last considerable prevalence, when there were 5,146 deaths. The rate per 1,000 works out at 0·09 for the year under review, as compared with 0·02 in 1898 and 0·06 the mean for the previous five years. Ten of the 31 districts appear to have been entirely free from the disease, and in six others only one or two deaths were recorded in each. The largest numbers were registered in Shahpur and Hissar, with 702 and 308 deaths, and millesimal ratios of 1·42 and 0·40 respectively. Lahore with 167 deaths (0·16), Mooltan with 117 deaths (0·19), and Gujranwala with 103 deaths (0·15) are the only other districts in which the figures are considerable.

Only 19 of the 150 towns reported deaths, the fatalities in nine being confined to one or two cases each; Tanda and Urmar in Hoshiarpur with 28 deaths returned a rate of 2·41 per 1,000, and in the cantonment of Mian Mir 70 deaths were recorded, giving a rate of 4·05 per 1,000.

The only considerable outbreaks were those which occurred in the famine camps in the Hissar and Shahpur districts in December. In the former case it is suggested that the disease was imported by coolies from the North-Western Provinces, but no definite details in support of this view are supplied. Three camps were affected, and altogether 389 cases with 297 deaths were recorded, the high mortality being ascribed to the debilitated condition of the refugees. The disease is believed to have been transported thence to the famine camps in Shahpur, and there is the definite evidence that people arriving by train suffered from diarrhœa and vomiting, but "the disease was only recognised after their arrival in camp." Altogether there were 1,186 seizures and 684 deaths up to the end of the year. The Sanitary Commissioner visited all the famine camps and supervised measures for the suppression of the disease.

As regards the seasonal incidence, only four deaths from cholera were recorded during the first six months of the year; 71 fatal cases in July were followed by 433 deaths in August, and thereafter there was a diminished prevalence till December, when the maximum number of deaths, 906, were recorded.

Central Provinces.—During the year there were only 76 deaths registered from cholera in the Central Provinces, the number having been seven only in 1898; there has been no approach to this immunity in the previous records of the province. The death-rate on the total population works out at 0·01 per 1,000, as compared with 2·79 the mean for the previous five years, over 50,000 deaths having been recorded each year, in 1896 and 1897.

One death occurred in April and one in October in the Nagpur district; and there were 10 fatal cases in November and 64 in December in the Nimar district and the neighbouring Burhanpur subdivision. As regards this, the only considerable outbreak, it is noted that 17 villages out of a total of 761 in the area were affected.

Berar.—In this province, which was entirely free from the disease in 1898, the comparatively small number of 541 deaths were reported as having occurred in 1899. Cholera broke out at the end of August simultaneously in two villages in the Amraoti district, on the 2nd September in a village in Ellichpur, and shortly afterwards in two villages in the Akola district. The first two villages are situated on the banks of the Purna river, whence they draw their water supplies. The origin of the outbreak was not definitely ascertained, but some of the inhabitants had recently returned from a fair. Thence the disease spread by human intercommunication to the other villages affected, and prevailed during each of the last five months of the year. There were altogether 1,216 cases with 541 deaths (44 per cent.), the largest number of fatalities, 294, occurring in October, and falling to 35 in December. Three of the six districts were entirely free of the disease, which was remarkably local in its incidence, the mortality rate calculated on the whole population being only 0·2 per 1,000, as compared with 2·6 the quinquennial mean.

Madras.—Save for the year 1895, we have to go back to 1887 to find a cholera mortality in the Madras Presidency as low as that of the year under review. There were altogether 29,082 deaths from this disease recorded in 1899, a ratio of 0·9 per 1,000 as compared with 2 per 1,000 in 1898, and the same figure for the average of the preceding five years. The greatest number of deaths occurred in Salem district, where there were 5,568 (2·8 per 1,000) in Tanjore, where there were 5,864 (2·6 per 1,000), and in Trichinopoly, where 3,287 were recorded (2·4 per 1,000); only two districts were absolutely free of the disease, although in three others, out of the remaining 20, the numbers of deaths reported did not exceed 20 altogether.

The Sanitary Commissioner gives interesting tables showing the seasonal incidence of the disease in the different areas, which are divided into two groups in accordance with their geographical positions, and the consequent climatological conditions, as mainly influenced by the two annual monsoons. As he has been able to show in previous reports, the incidence of mortality is greatest on the south-west monsoon districts during the progress of the south-west monsoon, that is to say, during the June to September deriod; whereas in the north-east monsoon group the mortality is greatest during the prevalence of the rain current, which specially affects these particular areas, that is to say, during the last quarter of the year. Whatever view be held as to the effective relation

between rainfall and cholera, there can be little doubt that, year after year, a definite relation in time is established in the two contrasted areas in the Madras Presidency, a relation, moreover, which finds supporting evidence in the seasonal prevalence of the disease in other provinces, and which is opposed to the usual sequence of events in Lower Bengal.

The rural death-rate was 0·8 per 1,000, 7·65 per cent. of the total number of villages being attacked; whereas in the towns the average death-rate was 1·5 per 1,000, only 50, however, of the total of 93 being affected, and in 11 towns the number of deaths recorded did not amount to 10 in each. The municipal towns suffered at the same rate as the rest (1·5 per 1,000), the highest mortality occurring in Vaniyambodi (18·7), Gudiyattam (14·2), Tiruppattar (11·3), Hospet and Ambur (10·8) and Salem (9·0).

In connexion with the view "that water contaminated by the specific germ is the chief method of local propagation of the disease," the testimony of the District Medical Officer of Salem, the district chiefly affected, includes one or two suggestive remarks. He says that "the worst outbreaks are invariably in taluks where the population is chiefly dependant on river-water for drinking. It was an impossible task to prevent the use of the infected water, or its constant re-infection. In villages and towns dependant on a well-water-supply, cholera outbreaks have been promptly checked by closing infected wells, and preventing infection of others by appointing caste-watermen and guards."

Coorg.—In this small province not a single death from cholera was recorded during the year under review, a fact which it has been possible to record on no less than seven previous occasions during the last 21 years. There were eight deaths in 1898, 106 in 1897 and 49 in 1896.

Bombay.—During 1899 cholera is reported to have caused 8,579 deaths throughout the Presidency, or 4,211 more than in the previous year, the millesimal ratio being 0·46 against a quinquennial mean of 1·48 More than half the total, *viz.*, 4,474, occurred in the district of Belgaum, where the death ratio was 4·42 per 1,000; Karachi district returned 2,394 deaths (4·27 per 1,000), and Dharwar, with 1,335 deaths, had a ratio of 1·27 per 1,000. The disease in its epidemic form was practically confined to these three collectorates; 12 of the 24 districts were entirely free from a fatal case, and it is only necessary to note further that there were 111 deaths recorded in the city of Bombay.

Out of a total of 220 rural circles 26 were affected, but in only nine did the death-rate from this cause exceed 3 per 1,000; the disease was most prevalent in one rural circle each of the Karachi and Kanara districts, in five circles of the Belgaum, and in two of the Dharwar district.

Only five of the 56 towns were affected in any notable degree, although 12 in all reported fatal cases; Karachi, with 2,064 deaths, suffered severely, the death-rate from this one cause being 21·25 per 1,000. Next comes the small town of Gokak in the Belgaum district, which, with 129 deaths, had a death-rate of 10·66 per 1,000.

There are altogether 25,143 villages in the Presidency, but only 461 were affected, and considerably more than half of these were in the Belgaum district, where every fourth village was attacked. The average rural death-rate was 0·37 against 1·09 in the towns.

The disease was most prevalent in April and May, and least in January and December.

Burma.—There were altogether 4,942 deaths from cholera registered in Lower Burma during 1899, a ratio per 1,000 on the census of population of 1·11, as against 0·66 per 1,000 in 1898, and an average of 1·2 for the previous five years. The disease prevailed in every district save one (Toungoo), the highest mortality being registered in Mergui (5·04 per 1,000), followed by Amherst and Myaugmya, with 2·47 and 2·08 per 1,000 respectively.

The percentage of villages attacked was 6·52 for the whole province, but ranged from 16 in the Irrawaddy division to two in Minbu, the average number of deaths recorded on each village being three in the former case and seven in the latter.

The rural death-rate was 1·01 per 1,000 of population against 1·79 for the towns, the mortality in Mergui (17·95), Ngathamggyaung (7·49), and Moulmein (6·67) chiefly accounting for the excess in the category. Out of a total of 33 town-circles, 25 were infected, and 15 returned a death-rate above the average for the province, but the most marked instances have been referred to.

It is noted by the Sanitary Commissioner that the 4,942 deaths recorded represent a mortality of 95·31 per cent. on the total number of cases reported, *viz.*, 5,185; this fact was alluded to in the previous section not only as indicating defective registration, but as emphasizing the difficulties attending enquiries into the etiology of the disease, in its epidemiological aspect.

In Upper Burma the number of cholera deaths registered in the 12 selected districts in 1899 was 2,050, or 0·84 per 1,000 of the population, against 1·11 for the lower province. Only two of the districts were free from the disease in its fatal form, but only 4·7 per cent. of the total number of villages were attacked; the highest mortality was recorded in the Mandalay district with 1·58 per 1,000 (568 deaths), followed by Saigang with 1·45 per 1,000 (356 deaths).

The rural death-rate was 0·79 per 1,000, compared with an average of 1·17 in the towns, eight out of the 13 among the latter being affected, by far the highest mortality being recorded in Monywa, where 133 deaths furnished a death-rate of 21·06 per 1,000.

In both Upper and Lower Burma the season of maximum prevalence was the period from April to October inclusive, but while the disease was epidemic in each month throughout the year in the latter area, no deaths were reported in Upper Burma in January and February.

Summary of cholera registers.—The European troops and the prison population shared the general immunity from cholera enjoyed by the people. Only one case, and this had a fatal result, was recorded among the former; this phenomenal freedom from the disease has no parallel in the medical annals of the army in India. The single victim, an artilleryman, was a patient in hospital, where he had been under treatment for 20 days for palpitation of the heart; at the time, cholera was prevalent among the native population of the cantonment (Mian Mir), and a follower of the battery was seized with the disease and admitted to hospital in the same enclosure as the European Ward. The soldier in question, who was a patient in the latter ward, was attacked four days later with a fatal result. Twenty-seven inmates of the same hospital were promptly removed to an empty barrack and no other case occurred among the troops, although six more of the followers in the lines were attacked. The virus in this case was abundantly present in the surroundings, but nothing definite was ascertained as to the means of infection of the European victim.

Among the jail population, with an aggregate average strength of 98,275, there were only 84 cases of which 51 ended fatally; and these were distributed among 18 jails, of which eight are in Burma, four in Bengal, two in Assam, two in Madras, and one each in the North-Western Provinces and Central Provinces. But the only considerable outbreaks were in the Gauhati Jail (Assam), which returned 25 cases with 18 deaths, and in Moulmein Jail (Burma), where there were 20 cases and 12 deaths; in twelve jails there were only one or two cases recorded in each, and nine of these twelve had each one fatal case.

As regards Gauhati, cholera had been very prevalent in the district and in the immediate surroundings of the jail for over two weeks, when one day no less than eleven prisoners were attacked, the first of whom and four altogether, had been employed in the jail garden, and none of whom had been less than one month in confinement. The garden is watered by a foul tank, the water of which was also used by two sweepers, subsequently attacked, for cleansing the latrine gumlahs. The prison water-supply is derived from the Brahmaputra river, which is filtered under the auspices of the local municipality and subsequently boiled before use by the prisoners, but it is insufficient for bathing purposes, unfiltered water from the same source being laid on; prisoners are known to drink from this bathing supply, and they were also in the habit of washing their hands and feet in the garden tank. Persons having business relations with the jail also had access to the garden, and it is suggested that they infected this source. Having regard to the habit of natives of washing out their mouths after ablution, the medical officer concludes that all the evidence available points strongly to the tank-water as the mode of infection, as no less than seven men attacked, including four of the first cases, were employed in labour that brought them into intimate association therewith. Three barracks and the hospital, accommodating altogether 65 men and in which 14 cases had occurred, were evacuated, and the occupants moved into extramural camps; no case occurred subsequent to this movement.

In Moulmein town, cholera had been prevalent for over four months and cases had occurred in the bazars in the vicinity of the jail; it is also stated that the disease was definitely associated with the use of the river water on which the town stands and from which it draws its supplies.

The jail derives its water from the rainfall collected and stored in a reservoir on an uncultivated hill after percolation through the sandstone, whence it is conveyed in a covered conduit, and is subsequently boiled before use by the prisoners, and this source of infection is absolved of any influence in the outbreak. The details given, however, are

not sufficiently full and explicit to carry conviction on this point. The prisoner first attacked had been rigorously confined to jail for one year, and the medical officer is at a loss to account for the means of his infection; two of the subsequent cases, however, occurred in the persons of cholera sick attendants. But it is to be noted that out of the fifteen cases that occurred in the jail prior to the movement into camp, fourteen were associated with the two main dormitories and the hospital; the under-trial prisoners and the women who are closely segregated in separate enclosures were entirely free from the disease. The outbreak then presents the features, not of a general epidemic from one common source as from the water supply, but rather suggests a casual infection of the first case, transmitted to the second victim who was an attendant on the first, and thence spreading by association among men living in close contact.

The troops of the Native army were not nearly so fortunate as their European comrades. Fourteen bodies of men located in twelve separate cantonments or camps were attacked; there were altogether 247 cases with 135 fatalities. The severest outbreak was that to which the 42nd Gurkha Rifles were exposed en route from Shillong to Abbottabad, when 58 men succumbed out of 105 attacked, including five deaths and eight cases among followers.

The statement below shows, in all cases where the details are available, the number of buildings occupied by the communities attacked, and the proportion which furnished cases of the disease:—

Communities.	Number of buildings occupied by communities attacked.	Number of buildings which furnished cases.	Percentage of buildings which furnished cases.
European troops*	—	—	—
Native troops	1,386	71	5·12
Prisoners	171	41	23·98

* There was only one case, which occurred in hospital.

No special relation between particular meteorological conditions and the occurrence of cholera was established.

Attendants attacked by the disease.—The total number of cases treated among the troops and their followers and the prison population was 322; the aggregate number of sick attendants was 427, and of these last, eight persons in all were attacked, or about 1·8 per cent. Some of these are stated to have incurred the disease by gross carelessness as regards the simplest precautions, for example, eating with unwashed hands, and drinking from the vessels provided for the sick.

In the reports of previous years ample evidence is given of the value of judicious movement of bodies of men among whom the disease has broken out; the registers of the past year testify emphatically to the great and immediate practical advantages of this established procedure, though it is only one of a series of precautions, the whole direction of which is to eliminate one or other of the chief factors from the chain of causation.

It will be interesting to many to see the actual figures showing the death-rate from cholera during the last 20 years in the three groups just mentioned and in the general population, even though all discussion of their significance be avoided on this occasion. The ratios of mortality attributed to the general population must, however, be understood to be only an approximation to the truth, which defective registration makes it impossible to obtain.

Death-rates from cholera per 1,000 *of population for the past* 20 *years in four quinquennial periods.*

—	1880–84.	1885–89.	1890–94.	1895–99.
European troops	1·83	1·55	1·44	0·55
Native troops	0·87	1·40	1·48	0·50
Jails	2·04	3·63	2·47	1·35
General population	1·15	1·55	1·59	1·54

Small-pox.

The mortality ratio of India from small-pox was in 1899 reduced by 17 per cent. from that of the preceding year, and by 43 per cent. from that of the quinquennium 1894–98. The highest numbers of deaths occurred in the months of May, April and March; and the lowest in the months of September, October and November. The reduction of deaths was greatest in January and February, and continued up to the end of August; after which there was an increase, greatest in November and December. The total number of deaths for the year was 53,347 against 62,517. Only in the Punjab, the Central Provinces and Lower Burma, among the larger provinces, was the mortality higher than in 1898; and only in Lower Burma and Madras was it higher than the quinquennial ratio. The greatest reduction from the quinquennial ratio was in Assam, and the greatest increase in Lower Burma.

The following table shows the mortality from small-pox in the different provincial registration areas of India in 1899, month by month:—

Statement showing the deaths from Small-pox registered in the different Provinces by Months during the year 1899.

Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of deaths per 1,000 of population	
													1899.	1899.	1898.
Bengal	1,309	1,255	1,401	1,595	1,834	1,249	1,059	779	509	512	600	1,014	13,116	0·18	0·20
Assam	188	147	210	196	283	198	116	54	53	37	19	64	1,565	0·31	1·03
North-Western Provinces and Oudh	172	149	272	456	412	242	161	103	32	25	22	20	2,096	0·04	0·05
Punjab	188	231	286	356	564	635	512	320	244	352	627	834	5,149	0·25	0·24
Central Provinces*	45	74	117	140	137	129	107	72	32	19	37	155	1,064	0·11	0·09
Berar	23	37	30	45	45	49	14	5	3	—	12	42	305	0·11	0·21
Lower Burma	263	606	1,097	1,019	800	588	368	405	198	213	126	208	5,891	1·32	1·07
Upper „	33	44	81	215	269	206	121	57	16	39	65	74	1,220	0 50	•
Madras Presidency	949	1,085	1,456	1,465	1,070	1,208	1,379	1,443	1,465	1,487	1,558	2,126	16,991	0·51	0·62
Bombay „	116	152	179	187	164	161	155	129	94	78	148	383	1,946	0·10	0·10
Ajmer-Merwara	79	94	100	159	165	55	28	12	—	10	36	224	962	1·77	0·75
Coorg	1	11	6	—	4	2	1	—	1	—	1	1	28	0·16	0·13
Mysore	338	428	354	268	223	230	225	160	151	163	220	254	3,014	0·62	1·35
Total	3,704	4,313	5,589	6,131	6,270	4,952	4,246	3,539	2,798	2,935	3,471	5,399	53,347	0·24	0·29

* Excluding Zamindaris.

The highest rural district ratios in India were those of Dewair in Ajmer-Merwara and Puri in Bengal; and the highest town ratios those of Hassan in Mysore, Kawkareik in Lower Burma, and Peshawar in the Punjab. Dewair rural area and Kawkareik town showed the greatest increases over the ratios of the preceding year. The greatest percentage of rural districts with high mortality was in Madras, and the greatest number of districts without small-pox mortality in Bombay. The greatest percentage of towns with high small-pox mortality was in Mysore, and the greatest number of towns without small-pox mortality in Berar. The proportion of child-mortality in total small-pox mortality was highest in the Punjab, and lowest in Coorg. There were two deaths from small-pox among the European seamen in the port of Calcutta, against none in the three preceding years; but there were none in the native floating population. In the Bombay harbour only one case of small-pox was observed, in the person of a European passenger who arrived by mail steamer.

The following are the more interesting of the remarks made on the subject of small-pox by the Sanitary Commissioners of the various provinces:—

Bengal.—As in the previous year, the three highest ratios were those of Puri, Cuttack and Balasore. In fact, over two-thirds of the total deaths from this cause in the province were returned by Orissa alone. Although the death-rate in Puri is lower than that in 1898, it was still very high,

and was due to the continuation of the outbreak which began last year, the epidemic being chiefly confined to thanas Puri, Pipli and Khurda. As regards the very severe prevalence of the disease in Cuttack, the Civil Surgeon reports as follows :—"The disease was prevalent during March to July in Salepur, Jagatsingpur and Jajpur, where people resort to inoculation. Cases of inoculation from these places were sent up for trial in the magistrate's court, and all the cases were proved against the culprits, who were heavily fined. The cause of the heavy mortality from this disease is the want of protection by vaccination, as the people are intensely ignorant, and do not appreciate the beneficial effect of this prophylactic, but always resort to inoculation."

Assam.—The disease has been very satisfactorily kept under by efficient vaccination in the Surma valley, especially in the Cachar district, in which it was practically non-existent. In the Brahmaputra valley the results were not quite so good ; many large sections of the people entirely refuse vaccination ; and, as it cannot be forced upon them, the only thing we can do is to wait until the mortality rises so high that their fears overcome their prejudices. The Darrang district was the worst.

Central Provinces.—As usual, the disease was most prevalent in the hot months, and declined in the cold season, although December proved an exception to the rule.

Berar.—Small-pox was not so widespread or so intense as in the previous year. There were 305 deaths in 165 villages as against 592 in 251.

Madras.—It must be remembered that vaccination is not compulsory in rural areas, and although a large section of the population appreciates its benefits, there is still some repugnance in submitting to the operation. Even where the mothers have no objection to the operation it is difficult to convince them that infants under one year of age can successfully bear the operation. Hence the risk to infantile life is considerable, more especially as a Hindu mother considers it necessary to show respect to the goddess of small-pox by joining in assemblies in crowded rooms, where, in the presence of the small-pox patient, ceremonies are performed to the deity. Revaccination, which, as the population emerges from being but a partially-protected to being a fairly-protected population, must become of greater importance, is rendered difficult in advance by it being conceived that small-pox is a disease of infancy, from which the adult has little real cause to protect himself—a conviction obviously of the same origin as the European estimate of measles, namely, that infection spares not the child, but passes over the adult, who, it is apt to be forgotten, has usually acquired immunity consequent upon an attack of the disease in infancy. The appearance of small-pox in a locality is at once followed by special vaccinators being deputed to the spot, but, unfortunately, it does not follow, in certain areas, that their services will be utilised by the people, as a distinct prejudice against vaccination being conducted in epidemics is often met with. Disinfection of infected houses and clothing is also employed. Much prejudice was encountered in the preceding year against vaccination, the people having hopelessly confused the operation of inoculation against plague with that against small-pox ; or, put in other words, an opinion existed that plague was being spread amongst the people by inoculation under the guise of vaccination. Happily, what at one time threatened to be a serious cause of retardation of vaccination has now subsided, as a result of common sense prevailing over the hysteria of panic.

Coorg.—In every instance where the disease broke out the first case was an imported one. "It is satisfactory," adds the Commissioner of Coorg, "to note that the public have regained their confidence in vaccination measures, which was seriously shaken by the plague inoculation scare, and freely come forward to be protected. It must be remembered that vaccination is only compulsory in the municipal towns."

Bombay.—The number of deaths from small-pox during the year, though higher than in the preceding year, was the lowest recorded, with two exceptions, during the last 12 years. The figures may be considered very satisfactory, and they testify to the exceedingly good vaccination work which now for some years has been done in the presidency.

Burma.—The importation of small-pox and its dissemination throughout the province are attributed to the unprotected cooly immigrants from India, large numbers of whom come to the country during the harvest season to reap the rice crop, and it is to be noted that small-pox prevalence was greatest in the Pegu division in the areas adjoining Rangoon. Most of the district reports assign the cause of the first cases to importation, and its further spread to the practice of inoculation, which would appear to be general throughout the province, and to be resorted to by the people as a protective measure when epidemic small-pox appears. Though inoculation is undoubtedly an active agent in the diffusion of infection, yet the most potent cause is insufficient protection of the people by vaccination ; for experience elsewhere has conclusively demonstrated the protective influence of efficient vaccination, and how small-pox mortality decreases in direct proportion to the protection of the population by vaccination. In Germany, for instance, where nearly everyone undergoes vaccination and revaccination, there is but little small-pox.

Plague.

There was a great increase of plague mortality in Bengal, the Central Provinces, Bombay, Madras, Mysore and Hyderabad, while it fell off in the North-Western Provinces and Oudh, the Punjab and Rajputana. Imported or suspicious cases were discovered for the first time in Berar, Ajmer-Merwara and Burma, but none in Baluchistan. Neither imported nor indigenous cases were observed in Assam or

Coorg. The following table shows the statistics, so far as they have been received in this office :—

Statement showing the deaths from Plague Registers in the different Provinces, &c., by Months during the year 1899.

PROVINCE OR STATE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL. 1899.	TOTAL. 1898.
Bengal	13	43	1,061	597	229	54	55	212	203	225	217	355	3,264	219
Assam	—	—	—	—	—	—	—	—	—	—	—	—	—	—
North-Western Provinces and Oudh.	—	—	—	—	—	—	—	—	—	—	1	6	7	148
Punjab...	4	14	29	125	31	8	3	—	1	9	10	21	255	2,019
Central Provinces ...	59	24	18	10	4	—	1	22	113	193	95	45	584	131
Berar	—	—	—	—	—	—	—	—	2	—	—	—	2	—
Burma	1	—	—	—	—	—	—	—	—	1	—	—	2	—
Madras Presidency ...	387	575	245	78	29	13	18	15	37	52	68	141	1,658	557
Bombay „ ...	6,933	7,429	8,964	5,303	2,955	1,826	7,343	13,992	16,974	14,526	6,322	4,029	96,596	86,191
Bombay Presidency (Native States).	416	1,332	1,415	1,217	729	447	1,476	2,796	3,057	3,648	2,039	855	19,427	17,672*
Baluchistan	—	—	—	—	—	—	—	—	—	—	—	—	—	18†
Ajmer-Merwara ...	—	—	—	—	—	—	—	1	—	—	—	—	1	—
Rajputana	2	5	3	—	—	—	1	4	—	1	1	6	23	124
Central India	—	—	—	—	1	—	—	—	—	—	1	—	2	3
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mysore	3,272	1,797	899	396	313	247	487	589	639	768	632	771	10,810	5,335
Hyderabad State ...	399	520	602	66	26	43	637	809	1,032	1,382	576	286	6,378	3,868
TOTAL ...	11,486	11,739	13,236	7,792	4,317	2,638	10,021	18,440	22,058	20,805	9,962	6,515	139,009	116,285

* From 1st January to 30th December, 1898. † Imported cases.

Before the completion of this report for the year 1899, Chapter VI. of the Report of the Indian Plague Commission, dealing with "Measures for the Suppression of Plague," has been received in India ; and in a resolution on it, dated the 16th July, 1900, the Government of India has laid down the rules of the general policy to be adopted throughout the country. It has, therefore, not been considered necessary in the following pages to record details of local procedure systematically, though some may be given incidentally. The resolution imposes not a new but a more fixed policy ; it clears up and settles points that were disputed, establishes well-tried measures, improves others, and rejects such as experience has shown to be inexpedient or impossible.

The following are short notes on a few points of scientific and practical interest concerning plague :—

Insects.—The question as to the participation of insects in the conveyance of plague is far from settled. In Oporto one patient suffering from the pustular form of plague said that his disease began from a bug-bite ; and it was judged that the first man attacked in Sydney had been infected by a flea-bite. It is considered probable by some that the infectivity of old rags resides in the fleas harboured therein ; and it has even been suggested that man is but incidentally affected by the rat-disease, plague, which, but for the mediation of insects, would remain confined to rodents. Daly, of Newchang, has reported a case in which a servant carried out a dead rat in his hands, and was attacked by plague the following day. The shortness of the incubation period suggests the possibility of previous infection. Otherwise, similar cases, reported by Simond and by Hankin, have been noticed in previous reports. Matignon in Mongolia noted, like Yersin, a heavy mortality among flies in plague time. The chief of the Pasteur Institute, M. Duclaux, evidently believes in the likelihood of the transmission of plague by insects, as among prophylactic measures he advocates the destruction of rats, fleas and bugs. On the other hand, on page 172 of the report for 1898, Müller, of the Austrian Plague Commission which visited India, is quoted as not having found any evidence of the

agency of insects in the conveyance of infection; and in the bacteriological part of the report, since published, Albrecht and Ghon state that they saw no striking mortality among flies, and that in about 700 experiments with animals they never saw infection take place by fleas, flies, lice, &c. They found, however, that flies which had been in contact with infected matter and were then allowed to run about over the surface of an appropriate nutrient medium left germs behind them which developed into colonies of the plague bacillus. On page 182 of the report for 1897 were given the conclusions of Simond with regard to the rôle of insects in the spread of plague. E. Calmette having stated that Simond had "proved that fleas are the chief agent of infection in this terrible disease," Nuttall replied:—

> The fact is that Simond has proved nothing of the kind, and it is altogether premature to accept Simond's generalizations, especially when that author does not know how to distinguish one species of flea from another, and has vague ideas about the mouse-flea and *Pulex irritans* possibly being one and the same insect. The experiments of Simond may be suggestive, but they are far too few in number to base any conclusions upon. A number of experiments made by me have given negative results. Simond rides his hobby to death when he speculates about the possibility of plague bacilli becoming increased in virulence by passing through the body of the flea! He ignores the facts established by my experiments which proved conclusively that various pathogenic bacteria are simply digested in the alimentary canal of the flea. I by no means deny the possibility of virulent bacilli escaping in the fæces, and, in fact, in experiments on bugs have proved that this is the case, but only within the first twenty-four hours after they have sucked infected blood. Numerous experiments on bugs and fleas have shown that *B. pestis*, *B. anthracis*, *B. murisepticus*, and *B. cholerœ gallinarum* die off in the alimentary canal of these insects. Another considerable series of experiments in which these insects were allowed to infect themselves and afterwards bite healthy animals gave uniformly negative results, proving that if this mode of infection is possible, it is the exception and not the rule. Of course, when an insect that has just filled itself with infected blood is crushed upon the skin, and the part scratched, infection may occur . . . . I express the hope that more accurate knowledge will be gained in the future upon the part played by insects, &c., in the transmission of disease agents. It is one thing to establish facts, it is another to write fancies. The time has passed when assertions can be accepted as evidence.

Galli-Valerio also reproached Simond with his ignorance of the flea fauna, and published an article containing descriptions and illustrations of fleas of man, of the rat, and of the mouse. He granted the possibility of the rat and the mouse being infected by their own flea, but pointed out that it had not been shown that the flea of the rat or the mouse could transmit the disease to man. Galli-Valerio also failed to induce the *Typhlopsylla musculi*, the most common flea of rats and mice, to bite himself, or even to remain long on his body; and he mentions that this was not because he is refractory to flea-bites, because the human flea bites him readily. He noted that neither the German Plague Commission in India nor the Italian in Oporto met with instances of the transmission of plague from rats by fleas to man; and added his own opinion that if transmission of plague by fleas is a fact, it is much more probable that the transmission is from man to man by the *Pulex irritans*. Tidswell in Australia is stated to have "confirmed the observations of Simond as to the part played by fleas, and to have demonstrated the existence of plague in the alimentary canal of fleas taken from plague-infected rats"; and "supports the view that, owing to the apparent ease with which the bacillus can be destroyed in nature, plague most likely finds the best mode of dissemination in hosts such as the rat and flea." Nuttall's remarks quoted above may serve as a commentary on the value of Tidswell's find as a proof of insect-transmission of plague. A writer in the *Lancet* says—"Galli-Valerio's rat-fleas would not bite him; but that proves nothing, for no flea will bite the present writer, and many other people, doubtless." He had apparently not noticed that Galli-Valerio, as quoted above from the original article, distinctly states that he is readily bitten by the human flea. Blackmore, again, is of opinion that it is only reasonable to suppose that the species of fleas which do bite human beings are as capable of conveying the disease from a diseased person to a healthy person as the flea of a rat is of conveying it from a diseased rat to a healthy one; and that it is, in fact, judging by clinical experience, extremely probable that vermin play an active part in passing plague on from person to person. It has lately been brought to notice that a hymenopterous insect in Cyprus can transmit anthrax to human beings either by its sting or by accidentally rubbing off on an abraded surface infective material conveyed on its body hairs; and with regard to this Dr. Manson "remarked upon the close analogy between the method of infection in plague and such diseases as this." In a discussion in Berlin in October, 1899, Pfeiffer said that the experiments of Simond were not quite satisfactory, that the whole question was still in obscurity, and that in India no such epidemiological influence of insects had been demonstrable. Sticker considered it doubtful whether rat-fleas ever came on to men. Gärtner pointed out that in general the several races of fleas remained confined each to its own host-genus; but that it was not impossible that they

might occasionally pay short visits to men, have a sample bite, and then go away. Battlehner declared that there were from 60 to 80 races of fleas, that each kind of animal had its own special flea, and that the flea of man was a cosmopolitan, though he was not sure that it went to rats and mice. The general result of the discussion was that the possibility of the agency of insects could not be disregarded, as it was evidently physically possible that they might be directly or indirectly concerned in the introduction of the virus through skin, or in its deposition upon food, implements and furniture. The following appears to give a fairly good account of the present position of the question. It is said to have been written by a member of the German Plague Commission in reply to an inquiry :—

The plague is spread in two ways--first, from man to man : (*a*) by contact, and (*b*) by inhalation ; secondly, from the surroundings of man to man : (*c*) by contact with infected inanimate objects, and (*d*) by the transfer of the contagion from rats to man. We have no difficulty in explaining (*a*) as the penetration of plague germs through wounds or scratches, and (*b*) as the inhalation of minute germ-laden drops of moisture from the lungs of a plague patient. But the second method is less simple. No doubt contact with infected clothes is to be explained as in (*a*). But it is more difficult to understand why living among infected surroundings, *i.e.*, in an infected house, should cause infection without there having been any proved "contact." In this connection we have the disease of rats as an important factor, a factor not similarly observed in the case of any other infectious disease. Rats generally suffer from a form of plague which occurs in man very rarely, if at all, namely, plague of the intestines. When thus diseased they evacuate great quantities of plague germs. It is probable that numbers of plague cases among human beings are due to contact with evacuations of diseased rats, *e.g.*, in the case of the flooring thus contaminated being trodden on by the naked foot. Less probable is the inhalation of such germs in the floor dust, because plague germs are easily destroyed by desiccation. Children often infect themselves by crawling on the floor, and then putting their fingers in the mouth ; thus getting plague with neck buboes. A second possible method in which rats might convey the plague to human beings is by fleas. It is scarcely to be doubted that a flea which has bitten a sick man, and then bites a healthy man, can thus inoculate with the plague ; though it is not clear that this method is as frequent as many investigators, *e.g.*, the French school, are inclined to think. This much is certain, namely, that there are from 60 to 80 different kinds of fleas ; and nearly every animal rejoices in his own particular kind of flea ; so also rats. Now, it is understood that fleas go from beasts to man ; but it is not so certain they will all bite man. No doubt a flea need not actually bite in order to infect. If it causes itching by crawling on the skin, and the person concerned rubs at himself to allay the itching, he may conceivably rub the infected blood from the flea into his own system. It is also asserted that the fleas infesting man are of catholic tastes, *i.e.*, go over to beasts, *e.g.*, rats; and then return, infected, to human beings. Infection by fleas becomes rather doubtful through the fact that in India the relatives of the sick have often, though not sick themselves, been taken to the hospital and have rarely fallen ill, though they most probably have brought fleas in their clothes which might have conveyed the disease from the patients to themselves. It is also on the flea theory of infection not easily intelligible why doctors and nurses are so rarely attacked. The question of infection of plague by fleas cannot therefore be readily answered at present. The fact that when infected houses are once well cleaned and aired they do not give rise to further attacks also speaks against the flea and bug theory, for these are not so readily driven out of houses.

The idea that insects play a part in the propagation of plague is facinating, especially at the present time, and no doubt the supposed intervention of insects seems to explain some otherwise obscure points in the epidemiology of the disease ; but all that can be said at present on the subject must be mere theorizing, on account of the absence of facts. As was said in the report for 1897, however (page 186), there is sufficient suspicion attaching to the possible rôle of insects not only to justify but to call for further research.

Rats.—While from several parts of the world (Asia, Africa, Australia) reports have been received of the discovery of the plague bacillus in the bodies of rats found dead of naturally-acquired plague, and while rat mortality has been noticed in connexion with most outbreaks, yet cases have been recorded both in India and in Europe where there was marked participation of rats, and at the time of a human outbreak in Russia a veterinary bacteriologist is said to have made more than 3,000 post-mortem examinations of rodents without being able to find the plague bacillus.* In fact, the exact connexion between rat plague and human plague has not yet been determined. The soil, articles of food eaten raw, fleas, have been thought of as possible links in the chains of causation, and the benefit of evacuation of affected premises has been ascribed to the fact that the rats are left behind. In a few cases direct infection by the bites of rats has been observed. Clemow, in the course of a very valuable paper dealing, among other subjects, with the relation of rats to plague, says that for the present it must be admitted that rats can and do suffer from plague under natural conditions ; that they can and do act as a means of diffusing infection, and transmitting it to man ; but that the extent to which they are

* The absence of rat infection was supposed to explain the ease with which this outbreak was controlled.

responsible for the diffusion of the disease, and the distance over which they diffuse it, are uncertain; and, finally, that they are an important, but not the sole, means of spreading the disease. It has, therefore, been proposed to wage war against rats with traps, poisons, suffocating gases, artificially induced epidemic diseases. Löffler, Laser, Mereshkowsky, Issatchenko, and Danysz, all isolated from cases of spontaneous disease in mice microbes capable of producing epidemic outbreaks in these animals; but only Danysz so far, apparently, has rendered his microbe regularly virulent for rats. The practical experiments in ridding country-sides of field mice do not seem to have been uniformly successful, and do appear to have required some amount of care and skill; and the question may be, not whether rats are to be destroyed, but whether it is practicable to destroy them. It has been somewhat pertinently asked—"If the plague bacillus, to which rats are so extremely susceptible, does not exterminate the rats, why is it expected that these other microbes will do so?" However, perhaps keeping down the number of rats by the use of a microbe not pathogenic to man, might have some effect in checking plague. On the other hand, it is not known whether the absence of rats might not give opportunity for the increase of some other evil.

Cats, dogs, monkeys.—There is this year, for the first time, some evidence to bring forward to show that cats may occasionally take a part in the spread of plague. Lorans, in Mauritius, mentions that in several cases it was possible to trace infection in the human subject to plague-stricken cats with open cervical buboes, in which, moreover, plague bacilli were discovered. A case, too, is reported from Australia in which a cat was actually found to be suffering from plague, the bacillus being found in the swollen cervical gland. The Austrian Plague Commission succeeded in infecting three cats by feeding, and all developed cervical buboes; and Di Mattei points out that the excrement of infected cats is infectious. Some less definite reports on plague in cats have also been made. The Austrian Commission, too, found the excrement of infected dogs to be dangerous; and, according to Yersin, village dogs have been known to die from eating or biting infected rats. A case has been reported by Hanna of natural infection of a monkey in a state of captivity. The body of the animal was examined in the Bombay Plague Research Laboratory, and the plague bacillus was demonstrated microscopically and culturally in the heart blood and in the tissue of the axillary bubo and of the spleen.

The Bacillus.—With reference to what was said in paragraph 154 of the report for 1898, it may be noted that Ogata has, with the agreement and consent of Kitasato, reported to the Japanese Government that the plague at Kobe was caused by the bacillus of Yersin, and not by that of Kitasato.

Mode of entrance.—One of the most important observations made by the Austrian Plague Commission was the fact that they could infect a guinea-pig, &c., by rubbing without any great force the skin, shaved or not, of one of the hinder extremities with infective material. So readily did infection take place by this method that they were able to use it as a test for the presence of the plague bacillus in suspected material; for example, fæces.

Danger from convalescents.—It has been shown by Gottschlich and by Métin that the sputum of patients may continue to harbour virulent plague bacilli for days or weeks after convalescence has been established.

Endemic centres. Westward spread.—Zabolotny and Clemow have published memoirs on the endemic centres of plague throughout the world. Clemow concludes that the present epidemic of plague started from South China. In certain quarters the fear was expressed that plague might be exported from India by small sailing vessels which ply between Cutch Mandvi and Madagascar, Zanzibar, Mauritius, Jeddah and the Persian Gulf; but no such transport of plague has been proved, and the arrangements at Cutch for the inspection of vessels sailing to ports out of India were, on inquiry in 1899, found to comply with the terms of the Venice Sanitary Convention.

Plague in Egypt.—Instructive reports on the plague in Egypt have been published by the Egyptian Sanitary Department, and also by Gottschlich, an officer of the department, embracing such topics as the origin of the epidemic, the epidemiology (including the part played by rats, in this case not conspicuous), statistics, clinical observations (including a case of injury to the left little finger at a *post-mortem* examination on the 29th May, and appearance of the axillary bubo on the 3rd June; and cases in which the bacillus was found in the sputum of patients many days convalescent from pneumonic plague), bacteriological researches (including diagnosis, degree of virulence, resistance of

the bacillus to unfavourable environment, Haffkine's vaccine, experiments on animals), considerations as to how the bacillus leaves the body of a patient, and, finally, the measures adopted and their effect.

Plague in the Bombay Presidency.—At the end of 1896 there had been a total of 2,909 attacks and 2,086 deaths from plague ; 61,093 attacks and 46,944 deaths were recorded during 1897 ; 1898 saw 110,369 attacks and 86,191 deaths ; while in 1899, as may be seen in the table on page 104, 126,287 attacks and 96,596 deaths were registered. The epidemic continued throughout the year, and was at its lowest intensity in June, and reached its maximum in September. Only one district, Thar and Parkar, remained uninfected throughout the year. The number of towns and villages affected was 2,256 against 1,188 in 1898. The highest ratios of mortality were in the collectorates of Poona (17·94), Belgam (12·63) and Nasik (10·03).

In the Poona collectorate plague occurred in all the talukas. The maximum mortality, 5,947, took place in August. The greatest number of deaths from plague, 10,229, was recorded in the town of Poona, this epidemic of exceptional severity causing the flight of about half the population. The Haveli taluka, in which the city of Poona is situated, returned 5,037 more deaths from the disease. In the city cases occurred in every month of the year, but from May, 1898, up to February, 1899, it is said to have been free from *indigenous* cases, though the occurrence of 37 imported cases caused anxiety. Thirteen of the 37 were detected at the railway station ; seven also came by rail, but were not detected till after the persons had become residents ; and 17 were imported from neighbouring villages. Of the last mentioned 24, five were discovered by means of death certificates, two were found ill on the road, two occurred in an observation camp, and fifteen were discovered by the surveillance system. Every effort was put forth to prevent the establishment of infection, and up to the middle of February no spread of the disease occurred. But in spite of all precautions plague became indigenous towards the end of February, and gradually broke out into the severe epidemic just mentioned. In the whole collectorate 262 towns and villages were affected, and there were 25,239 attacks and 19,047 deaths reported.

As in 1898, the disease was prevalent in Belgam during the entire year. In 1899 it had reached its minimum in April, but from that month it showed an increase till in August the maximum was reached, and for the next two months the mortality was nearly the same, after which a decline set in. The total for the year was 335 towns and villages, 17,875 attacks and 12,772 deaths. Dharwar was affected during the whole year. The year opened with 1,869 deaths in January, and the disease gradually declined till April, when the minimum, 96 deaths, was recorded ; it again increased rapidly, when the maximum, 1,917 deaths, was reached in October ; 382 towns and villages were affected, and there were 12,066 attacks and 9,183 deaths reported. The collectorate of Satara was affected throughout the year, and in all registration circles, except Malcolmpeth. The highest mortality, 2,358, took place in October. Amongst the circles, Karad rural circle returned 2,405 deaths. The town of Karad recorded 908 deaths. In the whole collectorate 298 towns and villages were affected, and there were 12,175 attacks and 8,740 deaths. Nasik was affected during the whole year. From January to June it was to a limited extent, but the mortality suddenly rose from 130 deaths in June to 768 deaths in July, and continued increasing until the maximum was reached in September, when 2,976 deaths were recorded. It declined just as rapidly, and the minimum was recorded in December, viz., 27 deaths. One hundred and fifty-four towns and villages were affected, and there were 10,791 attacks and 8,441 deaths reported. The Thana district was affected during the whole year, as in 1898. In January the disease was on the increase, and this continued until March, when the maximum number of deaths, 970, took place, and then gradually declined until December, when 152 deaths were recorded. The total for the year was 146 towns and villages, 4,996 attacks and 4,362 deaths. The collectorate of Bijapur was affected throughout the year. The disease, which had commenced in September, 1898, was on the increase in December, but in January, 1899, there was a sudden fall, which continued until May, when there were only 5 deaths. The mortality then rose to 12 in June. In July it assumed a greater intensity, and in October it reached the maximum, 752, and fell in November to 535, and in December to 250. In all there were 124 towns and villages affected, and 3,935 attacks and 3,074 deaths. The plague was at its highest intensity in the Kurrachee district in March, April and May, after which it was kept within narrow limits. Kurrachee town circle suffered the most during the year. In the whole collectorate 20 towns and villages were affected, and there were 3,235 attacks and 2,359 deaths reported.

In 14 Native States of Bombay occurred 19,427 deaths from plague; 13,566 in Kolhapur, 1,973 in Cutch, 1,883 in Baroda, and lesser numbers, decreasingly, in Aundh, Bhor, Savanur, Rewa Kantha, Kathiawar, Akalkote, Janjira, Palanpur, Savantvadi, Sachin and Mahi Kantha.

Plague in Bombay City.—As in 1898, the city of Bombay was affected during the whole year. The total for the year was 19,454 attacks and 15,874 deaths. The monthly distribution of the recorded deaths was as follows:—

January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1,591	3,118	4,758	2,315	1,008	228	261	348	368	449	436	994	15,874

The maximum was reached in March and the minimum in June. Already in November and December, 1898, the outbreak had begun in twenty of the sections of the city, including Mahim and Worli. In the week ending 3rd January, 1899, it started in Middle and Lower Colaba, Khetwadi, Girgaum, Tarwari and Sewri; in the week ending 10th January in Chukla and Mahalaxmi; in the week ending 24th January in Chowpatti; in the week ending 31st January in Walkeshwar; and in the week ending 7th February in Esplanade. During the outbreak of the first part of the year Fort South and Upper Colaba were but lightly touched, while Esplanade, Mahim and Worli had mortalities approaching double those they had had in the preceding outbreak. With regard to the second half of the year, nothing can be said for want of the Municipal Commissioner's report, which has not yet been received. The above table, however, shows that there was much less plague in the second half of the year than in the first. Some remarks applying to 1899 were quoted from the Municipal Commissioner in last year's report. Up to the 31st December, 1898, 27,887 persons had been inoculated with Haffkine's prophylactic; up to the 27th December, 1899, 113,941; and up to the 3rd January, 1900, 121,206; so that probably about 90,000 were inoculated in 1899. Besides plague, relapsing fever was also present throughout the year.

Plague in the Port of Bombay.—During the year 65,822 vessels of all sorts, with 1,193,339 crew and passengers, were examined. The number includes every person who left Bombay by sea during the year, as well as those who arrived from certain infected ports. Owing to the rigorous nature of the examination and the disinfection of suspicious clothing and bedding, very few fully developed plague cases were found at the time of inspection. The people did not present themselves if they considered they were in any way suspiciously ill. During the year 117 cases of plague were prevented from proceeding on vessels leaving the port, 34 cases were found in vessels and native craft in the harbour and at the docks and bandars, and 4 were found on vessels coming from infected ports close to Bombay; making a total of 155 plague cases. The number of persons who developed plague among those segregated in the camp during the year was 121. Three steamers entered the harbour each with a case of plague on board, and one landed a native passenger suffering from plague at an intermediate port during her voyage from Hongkong to Bombay. Five ocean-going vessels were reported to have had plague on board after leaving Bombay; but investigation left only one genuine case, that of the *Booldana* for Rangoon. At the time of the inspection of the vessel one of the saloon crew, a native cook, was missing. It turned out that the missing cook was at the time suffering from fever on shore, and did not like to face the inspection. He died of plague on shore a few days after the vessel sailed. The man who developed plague on board after leaving the port was another native cook who was found to have resided in the same house as that in which the first cook died from plague. The cook who developed plague on board was therefore a "contact." It is only reasonable to suppose that some of the coasting vessels must have conveyed cases to Kurrachee and the small ports north and south of Bombay; but on the whole they must have been comparatively few. The coast ports south of Bombay, to which the majority of the local passengers go, are free from plague. Kurrachee and Cutch Mandvi are the only ports on the coasts north of Bombay which are infected, and the disease is said not to have left them since the first outbreak in 1896. Unfortunately, plague has broken out at foreign ports, but, so far, no country or port can point to Bombay as being the cause of the plague from which it is suffering; at least in no case can outbreaks at foreign ports be traced to the crew or

passengers from Bombay, The question of infection by rats and cargo has been dealt with by the Indian Plague Commission. The Health Officer of the port continues:—

It is probable that plague of a mild type has been and is widely distributed in the East; and when at times it broke out as a mild epidemic the high mortality was attributed to an unhealthy season or year. At present every one is on the look out for plague, with the result that the true cause of the high mortality which occurs from time to time is recognized as being due to plague. I may mention that plague is endemic on the Arabian coast of the Red Sea between Leith and Lohea and that, owing to recurrent epidemics in October, 1893, July, 1894, August, 1895, and October, 1896, quarantine was imposed at Suez and Aden against arrivals from the infected ports of the Arabian coasts.

Plague in Bengal.—The plague deaths shown opposite Bengal in the table on page 104 belong, with the exception of 583, to the city of Calcutta, and in the same city were recorded all but 756 of the total cases. These 756 cases and 583 deaths were furnished by 16 districts, and in all the places the first patient was found to have come from Calcutta. In the Howrah district there were 162 cases and 111 deaths, confined almost exclusively to the municipality, and mostly of local origin. In the Hooghly district there were 20 cases and 14 deaths, which chiefly occurred in the municipal areas, as Hooghly-Chinsurah, Serampore and Bhadreswar. There were no cases after 5th May. The majority of the cases (106 with 79 deaths) in the 24-Parganas district occurred in the Gossipore-Chitpore municipality, which is practically a suburb of Calcutta, and were reported to be indigenous. Cases from Calcutta also infected the surrounding municipalities. Plague in the district of Dacca was introduced from Calcutta on the 12th February. Between the 15th February and the 3rd March nine other persons, who were infected by contact, died of plague. The disease was carried by a medical man to a neighbouring village. He died on the 23rd February, and between the 24th and 27th there were six other attacks in his house. There were outbreaks in two other villages from infection introduced from Calcutta. Altogether there were 74 cases and 65 deaths. No cases have occurred since May. The disease was introduced into the district of Faridpur by a resident of Bazitpore, who had lived at Hatkhola, Calcutta. He went home ill on the 18th February, and died there the next day. The relations and neighbours who tended him and the medical man who treated him all caught the infection, and communicated it to other persons. Thus by the middle of March the disease had spread to seven houses in Bazitpore, and the infection was carried to Shirkhara, 13 miles distant from Bazitpore. The District Magistrate reported that almost all the cases were pneumonic, and that persons who had attended on their sick relations were generally infected by inhaling the breath of the patients. The total for the district was 32 cases and 30 deaths. Into the village of Jhalwara, about 11 miles distant from the Durbhanga district headquarters, the infection was first brought by two Mahomedans, who arrived from Calcutta on the 7th March. One of them fell ill on the way, and died on the 10th after reaching home; while the other was attacked a day or two later, and died on the 16th. These men communicated the infection to their relations and neighbours; and in all 48 cases and 42 deaths were recorded. Into the Sarun district, wherein 162 cases and 132 deaths occurred, plague was introduced by an Ahir who came from Calcutta, and died of plague in the village of Kutuha on the 22nd January. This was not recognized as plague at the time, and was reported as fever. The next suspicious death in the village did not occur till January 29th. There was one case on February 12th, but deaths did not become frequent till the end of February; and it was not till March 15th that the local authorities heard of the outbreak and visited the village. Altogether, up to 1st April, 86 cases occurred in the village of Kutuha, 72 of which proved fatal. After a lapse of 28 days two new fatal cases occurred in the village, and the revival was believed to be due to infection carried by a dobhi in the clothes of the patients who had died of the plague in Abdul Hai village, where there were 17 cases and 8 deaths in March and April. After the 28th April the district remained free for some months, the disease breaking out again, however, in October, this time at Nayagaon in Sonepore thana. There can be no doubt that the infection came from Kutuha, which is a mile distant. By the end of the month three villages were affected, and 12 fatal cases occurred. Notwithstanding all precautions, the disease gradually spread, and five more villages adjacent to each other in Sonepore thana were affected, 47 cases and 34 deaths being recorded for November and December. The fair at Sonepore, which was close to the infected villages, had consequently to be broken up. In the Patna district were registered 126 cases, two in March, and 124 in December, with 87 deaths. A Hindu male, who on the 8th March had left his residence at Banstollak, a badly infected place in Calcutta, while actually

suffering from plague, arrived in the Patna city on the 9th, and died the next morning. Another case, also imported from Calcutta, occurred in the town of Behar, and ended fatally on the 24th. There was no further case in the district till November, when the disease reappeared in an epidemic form. The epidemic was introduced into Sheikhpura village in the Barh subdivision by a man coming from Calcutta, and it rapidly spread among the surrounding villages. Thus by the end of the year the town of Barh and about 28 villages, mostly in Barh thana, were affected. There was throughout the most determined and systematic concealment of cases and deaths. The other districts affected were Balasore, Shahabad, Tipperah, Nadia, Mozuffarpore, Khoolna, Singhbhum and the Sonthal Parganas. The first two had, respectively, seven cases with five deaths and six cases with six deaths, and the last three, each one fatal case.

Plague in the City and Port of Calcutta.—As the provincial Sanitary Commissioner has failed to furnish an account of the plague in Calcutta for the calendar year, and as the other reports available are for periods other than the calendar year, this paragraph is somewhat difficult to write. Out of the Bengal total of 3,565 cases and 3,264 deaths, 2,809 cases and 2,681 deaths were recorded in Calcutta; but the local plague authorities have reason to believe that the number of cases and deaths was really much greater. The monthly distribution of the recorded deaths was as follows :—

January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
13	43	770	489	199	49	51	201	202	213	196	255	2,681

From October, 1898, the disease had remained quiescent. Some few isolated cases were reported, which bacteriological examination showed to be plague; and there were a considerable number of cases sufficiently suspicious to lead to the disinfection of the houses in which they had occurred. The mortality during the whole of this period was above the average, and in the opinion of the Health Officer the greater part of the excess was, in fact, due to plague. "It was not, however, till the end of February, 1899, that the existence of plague was sufficiently demonstrated to warrant a declaration that Calcutta was again infected." The city wards most affected in 1899 were, from January to June, III, V, VI, I, XXII, and from July to December, XXII, VI, III, V and IX Major Deane, R.A.M.C., the Special Health Officer, says :—

> It is very clear that during the last six months of 1899, after the epidemic had subsided, the disease was hanging about, and, moreover, doing so in more or less well-defined areas scattered over the city. These areas, in which the majority of plague cases in the 1899 epidemic occurred had their infected foundations laid in 1898. To put the matter in an unconventional way, it looks as though the plague patrols had reconnoitred the city in 1898, and formed outposts, which were reinforced by the main bodies in 1899, and the forces then formed permanent camping grounds, sending out foraging parties into the surrounding neighbourhood, and then retiring into winter quarters. (In parenthesis let me say here, the above facts seem to indicate a plan of campaign: attack the enemy while in winter quarters;

The characteristics selected by Major Deane for special remark, says the Lieutenant-Governor, are the very low contagious and infectious properties which the disease has displayed; and in pursuing the reports the reader cannot fail to be struck by the remarkable contrast which both the mortality figures of the present visitation and the descriptive passages supplementing them present to the records of the various epidemics which depopulated in earlier times the regions they visited. With regard to the part which rats play in the epidemiology of plague, Major Deane is of the following opinion :—

> So far as Calcutta is concerned, up to the present there is no evidence that rats have had anything to do with the spread of plague, much less that they have been the chief mode of dissemination. So far from the human population having originally contracted infection from rats, the evidence is clear that rats have become infected after human beings, or contemporaneously with them, from a common source. As the epidemic grew worse, so did rat mortality become greater. If we knew how human beings get plague, we should know how rats get it, and *vice versâ*, perhaps.

Three hundred and nine vessels arrived in the port of Calcutta during the year from the plague-infected ports of Bombay, Kurrachee, Hongkong, Penang, Mauritius and the Hedjaz; but no cases of plague were found on any of these vessels. It appears also that no cases were found in the port or in vessels leaving it.

Plague in the Punjab.—The plague mortality statistics of the Punjab for 1899 are given in the table on page 104. The following is condensed from the report of Captain James, I.M.S., the Chief Plague Officer. The province had been reported free of the disease on the 20th September, 1898 ; but the village of Kariam was discovered to be infected on the 1st October, 1898, and from that date until September 9th, 1899, a succession of plague-infected villages came under observation and treatment. This second recrudescence of the disease was much smaller than the first epidemic. It was confined to a much smaller area, and fewer villages were infected. There were only 26 villages attacked in the Jullundur and five in the Hoshiarpur district. There were altogether 408 cases during this period, of which 220 proved fatal. Of these cases 359 occurred in the Jullundur district, and 213 were fatal. In the Hoshiarpur district occurred 49 cases, of which only 15 terminated fatally. The disease in the Jullundur district had still its former virulence and tendency to spread ; but the authorities were able to get much earlier information of the villages being infected than in the previous year, and in this way many places escaped with few seizures. With a few modifications, the measures adopted were the same as in the previous year. The chief feature of the year's epidemic was certainly the evacuation and disinfection of the comparatively large town of Rahon. The question as to whether plague can lie dormant in a village without cases of illness appearing has not yet been settled. In the case of Kariam it is believed that the disease existed in a mild form among the sweepers some time before it was discovered. Of the 31 villages which were attacked during the season in the two districts, nine suffered last year. In none of these could any evidence be obtained pointing to the disease being a recrudescence. In most of them there was clear evidence of the disease having been reintroduced from a neighbouring recently-infected village. In the other cases the disease appeared in a fresh quarter of the village and among a new class of the inhabitants, and usually avoided parts infected the previous year. The manner of infection from one village to the next was usually by human agency. But there are one or two facts which were very prominent throughout the epidemic, and are somewhat difficult to explain. The most noticeable was that women were almost always the first persons affected, even when men were suspected of being the means of bringing the infection. Another interesting point was that the first cases very frequently occurred on the outskirts of the village, even in cases in which the entrance to the mohalla was a road leading right through the village. The outlying infected mohalla in many cases faced the last infected village. Numerous cases came to notice where rats seem to have been the media of carrying infection from one part of the village to another. But this year there were no clear cases in which it could be traced that the infection had been brought by rats from another village. In one or two cases, *e.g.*, Shikopur, rats appear to have died before the people got attacked, but in these cases there was also a history of clothes (probably infected) having come from an infected village. In 28 villages of the Jullundur district 8,465 inoculations against plague were performed, and 719 in seven villages of the Hoshiarpur district. Some interesting points as to the effects of inoculation arose for consideration. The temper of the people was throughout admirable. They have come to appreciate the efficacy of the measures carried out for their benefit, especially evacuation of houses. In several cases they had begun to come out into camp before the plague authorities arrived in the village.

Kariam village in the Jullundur district.—Late in the evening of October 1st a report was received that plague had appeared in Kariam, a village situated about three miles south of Nawashahr, and between the villages of Bhangal, Ghataron and Hansron, which had been affected during the early part of the year, though Kariam itself up to this time had escaped. Captain Wilkinson, the Plague Medical Officer, visited the village the following morning, and discovered two Chamar boys in adjoining houses, who had well marked symptoms of plague. A woman living in the next adjoining house was beginning an attack of plague. On further inquiries being made, it transpired that at least two other persons had previously suffered from symptoms which were most probably those of plague. Up to the time the village was evacuated all who were attacked were Chamars, and all belonged to the same family. The whole village was evacuated by October 5th, and the systematic disinfection of all the houses completed by the end of the month. But, unfortunately, three persons were attacked with plague. These men had all been working in the village between October 24th and 29th ; but they had worked in different parts and only at whitewashing, which is the final stage of the operations, and succeeds the disinfection of the houses with chemical disinfectants. This pointed naturally to some defect in the measures taken. Live rats were seen when the

disinfection was first started. None were seen as the disinfection reached completion. Several dead rats were found during the operations, but Dr. Wilkinson was unable to satisfy himself that they had died of plague. When the village was redisinfected between the 7th and 27th November, in consequence of the occurrence of the cases just mentioned, more dead rats were found, though very few. Finally, after the second disinfection was completed, and before the people returned to their homes, live rats again began to make their appearance in the houses. Since, there has occurred an almost parallel case in the village of Bhangal, in which the cause could be traced, and which appears to furnish a clue to this case. At any rate it gives the only hypothesis which has any facts to support it, viz., that rats can and do reinfect the houses after they have been disinfected.

Langari village in the Hoshiarpur district.—From the 9th October, 1898, to the 8th April, 1899, there was no case of plague in the Hoshiarpur district. On the 8th April, village Langari, situated a mile and a half to the south-west of Mahilpur, and inhabited principally by Jat Sikhs, was found to contain three cases of high fever in a family of four who left Shikopur on or about the 28th of March, 1899. Mussamat Gulab Devi, one of the members of this family, and who only remained free from plague, said that a few days before her departure from Shikopur she found dead rats in her house there, and from last year's experience of Shikopur she was sure that plague would appear in the village. These three cases of Langari were subsequently found to be genuine plague cases; and it turned out that Mussamat Gulab Devi's son was the first plague case at Shikopur.

Plague in the North-Western Provinces and Oudh.—The plague statistics of the North-Western Provinces and Oudh for 1899 are shown in the table on page 104. With the exception of a couple of imported cases, one at Moradabad in February and one at Mau (Azamgarh) in November, neither of which gave rise to further cases, the provinces remained free from plague up to nearly the end of the year, when an outbreak took place at the village of Mau Amia, about 22 miles from Allahabad. In this village out of a population of 6,301, nearly a quarter are weavers, many of whom are habitually employed in Bombay, but have been recently obliged to return to their homes, owing to the contraction of the cotton industry. Among these a man named Khizir, with his son and daughter, arrived in Mau Aima on the 23rd of November, 1899, and the son was taken ill and died early in December. There is some uncertainty as to the date of his death, but it appears unlikely that he was actually infected at the time of his arrival. The assumption is that he became infected after his return, through the agency of clothing brought with him. The infected portion of the village was evacuated, houses wherein cases had actually occurred were burned, and all possible measures put in force; and these precaution appear to have been successful in confining the outbreak to a small number of persons, but dropping cases were still occurring up to the end of the year, the total number of seizures being 11, with six deaths. Inspections at border stations were steadily maintained throughout the year.

Plague in the Central Provinces.—In the table on page 104 are given the plague statistics of the Central Provinces for 1899. The total number of deaths was 584, against 131 in 1898. Cases of indigenous plague occurred in only two districts, Nagpur and Wardha. In the former, the first outbreak was discovered on the 16th February in Circle IV of the Nagpur city; though it was afterwards ascertained that deaths which there was good reason to ascribe to plague, had been occurring there for some 11 days previously. Both before and after the official recognition of the disease, the people left the infected locality in considerable numbers, and scattered themselves in the suburbs of the town, mostly in garden houses. Several deaths occurred in these places, but none of them became *foci* of the disease, and the outbreak appeared at the end of February to have been completely checked. On the 12th March, however, the disease broke out in Circle III, and from that date till the 6th May cases continued to occur in various parts of the town; generally, but not always, in the vicinity of the circle originally affected. The disease, which was probably imported from Wardha, never during this outbreak assumed the character of an epidemic. From the 7th May till the 12th August the city of Nagpur remained free from plague, but on the latter date the disease again made its appearance and continued till the end of the year. The first discovered case was in the person of a Brahman mendicant, named Mutanah, residing in Circle VII. Although Mutanah was not known to have left the city or visited an infected area for some weeks before his illness, the locality in which he lived had been under observation for some days, as several deaths of a suspicious nature had occurred there. It was subsequently

ascertained that a number of pilgrims had gone to the Pandharpur Fair, in the Sholapur district, and returned to Nagpur about the end of July, some of them having also visited Poona and Bombay before doing so. One of these pilgrims, named Baija Bai, soon after her return fell ill in Circle VII, and died on the 4th August in a house in Circle IV, to which she had been removed two days before, the period of her illness extending over a few days. Some other suspicious deaths occurred shortly after in the house adjoining the one in which she was attacked, and a further death of a similar nature took place on the 18th August in the house in which she died. The above circumstances, coupled with the fact that a further period of 16 days from the discovery of the first verified case, the extension of the disease was confined entirely to Circle VII, that for some time this circle furnished a preponderating proportion of cases, and that the areas affected in the former outbreak had not been specially attacked in this one, appear to indicate that this second outbreak was due to reinfection, and not to recrudescence. The outbreaks which began in the towns of Hinganghat and Wardha in the last quarter of 1898, continued in the first quarter of 1899; and it was during the prevalence of these epidemics that six villages in the Wardha district became infected in the early part of the year. The district, however, remained quite free of the disease from May to October. But in November there was a fresh outbreak in Hinganghat, the source of infection on that occasion having been traced to one Hiraman Kumbar, who, with his family, left Nagpur in October for Hinganghat, where he put up with the Kumbars of that place. Shortly after his arrival he and several members of his family were attacked with plague, from which they died. The disease then spread among the neighbours; but the outbreak was of short duration, terminating on the 19th November. About this time a number of Kumbars from the Hinganghat infected locality went to Pulgaon, where, shortly afterwards, three fatal cases of plague occurred amongst them and their caste-fellows. The necessary precautionary measures were adopted, with the result that no fresh cases occurred.

The measures at first taken to prevent the spread of the disease were those detailed on page 187 of the report for 1898. On the 17th September a public notice modifying the rules in force were issued to the following effect:—

(1) No plague patient shall be removed to the plague hospital unless he or his friends consent.

(2) No contacts shall be removed to the segregation camp against their will, and they may continue to live in the infected house if they prefer to do so. But, if they decide to leave it, they must undergo the usual period of segregation in the camp before settling elsewhere.

Shortly afterwards the restriction regarding compulsory segregation of contacts before settling elsewhere was removed, and the disinfection of persons and clothes substituted.

As soon as possible after the outbreak of plague a supply of Haffkine's prophylactic fluid was obtained from the laboratory in Bombay; and in the hope of inducing the people to resort to inoculation, and of removing any prejudice which existed against it, a notice in Hindi and Marathi was widely distributed. Altogether 4,331 inoculations were performed.

In most of the verified instances in Nagpur the disease was of the bubonic type; but in other localities whither the disease extended from this source it appears to have assumed a more virulent character, and the pneumonic form became the prevailing one.

Mortality among rats did not at first come to the notice of the officials; but the Sanitary Commissioner was informed that some of the natives in the plague camps had confessed that they had been in the habit of secretly burying dead rats found in their houses, to avert suspicion of infection. Afterwards their discovery became more common.

Plague in Mysore.—The statistics will be found in the table on page 104. The epidemic which commenced in Bangalore city on the 12th August, 1898, and in which some 6,000 lives were lost, almost completely subsided in March, 1899; and during the months of April and May there were no indigenous cases, so that the city was practically free for two months. In June it recrudesced, and the numbers steadily increased up to the end of the year. What the cause of the recrudescence was it is impossible to say. In Mysore city, which was first affected towards the end of October, 1898, the epidemic reached its height in February, and from that date it gradually declined. The epidemic never assumed such a serious character as in Bangalore, but this is attributed by the Sanitary Commissioner to the fact that no less than 29,000 persons were inoculated

before plague assumed an epidemic form. It may be said with safety, thinks the Sanitary Commissioner, that plague is now more or less endemic in the cities of Bangalore and Mysore. Of the remaining districts, only Kolar, Tumkur and Chitaldroog were infected. In the district the remedy is evacuation ; and, as the people are well aware of its benefits, little or no persuasion is necessary to get them out. Inoculation was very little resorted to. The class of people who are chiefly affected by plague are the poor, ill-clothed, and underfed, who live in dwellings devoid of fresh air and sunlight, and whose sanitary surroundings are of the worst description.

Plague in the Madras Presidency and in Madrâs City.—The general plague figures for Madras are given in the table on page 104. The following is shortened from the report of the Sanitary Commissioner. The total attacks in the presidency for the whole year amounted to 2,385, with 1,843 deaths. The plague epidemic, which had commenced in the last quarter of the previous year in the Deccan districts of Anantapur, Bellary and Kurnool, showed marked symptoms of diminution in March, and had completely disappeared within the first three weeks of May. In these districts there had occurred a total of 70 imported and 716 indigenous cases, with 56 and 588 deaths respectively. In the North Arcot district plague lingered up to a later date ; indigenous cases did not cease till the end of June. In this district there were 67 imported cases with 55 deaths and 647 indigenous cases with 501 deaths. In the Hosur taluk of the Salem district, however, although from May to June there was exhibited a decrease of indigenous cases, plague manifested a continued, though not severe, prevalence throughout the year. In December a second taluk in the Salem district was attacked. This followed a severe outbreak in the municipal town of Tirupattur, owing to a lamentable want of discretion on the part of the municipal authorities. The total imported cases in this district were 141, with 88 deaths, and the total indigenous cases 682, with 508 deaths. Kollegal taluk of Coimbatore was subjected to a short epidemic outbreak extending from October 7th to December 16th. In this district there were one imported and 47 indigenous cases with 37 deaths. Imported cases were also reported in Chingleput, Nilgiris, Trichinopoly, Nellore and Madras town. In none of these instances was importation followed by indigenous plague . . . So far in this presidency not a single instance has been recorded of what would be correctly understood as recrudescence. Indeed, were it not for the continued presence of plague in the Hosur taluk of the Salem district—a condition that may well be ascribed to the free intercourse which exists with the neighbouring infected Mysorean villages—it might be said that villages that have been once affected have escaped fully any recurrence . . . There was no change of the policy with which Government met the requirements of plague administration during the year. The method of detection trusted to has been that of inspecting travellers by road, rail, and sea, on routes communicating with infected areas, isolation of the sick, and requiring the healthy during the periods of possible incubation to be subject to surveillance whilst in no way restricting their movements. The district board, municipal, and village organisations lend themselves to the successful effecting of this scheme . . . It has been arranged that *before* starting from an infected village the inhabitant should obtain a passport, which, under the usual rules, will secure his surveillance whilst travelling beyond its limits . . . A system which demands that at certain points an uneducated native should be given a piece of paper, by which it is required that he should present himself for a period of 10 days to the plague authority at any village or town at which he may halt, may seem well-nigh visionary ; yet experience shows that under this simple method the free population may be allowed to pass from one end of the presidency to the other with fair assurance that both the passport-bearer and the local officer will fulfil their duties. By means of this system a large number of the imported cases have been detected at the very onset of the disease, and thus the possibility of spread has been enormously minimised. Of course, it has not been possible to ensure that all passport-holders should have been put under surveillance ; still, the amount of success which has attended the endeavour suffices to prove its great utility . . . A fair example of what can be done, even in large towns, is illustrated by results obtained in the municipality of Madras, where failure to trace passport-holders occurred only in 3·4 per cent. of 55,407 cases . . . It must be admitted that introduction of plague is possible by cases that have eluded surveillance ; yet the figures are so enormously in favour of successful surveillance, that no one can feel otherwise than that the system is of distinct practical value . . . In towns much passive opposition to evacuation of infected houses has been exhibited ; but in rural areas the benefit of rapid evacuation is often so well recognised that on the occurrence of plague there is a general exodus to encampments on clean sites outside the town. An officer of

the Indian Medical Service having adversely criticised the bacterial purity of haffkinine before the Plague Commission, the educated native public lost faith in anti-plague inoculation. As a result only 5,955 persons were inoculated during the year.

Plague in Hyderabad State.—The plague death statistics for Hyderabad will be found in the table on page 104. At the end of the year 1898 plague was declining throughout the Nizam's dominions, and this improvement continued with a slight upward fluctuation in March, during the first five months of 1899, so that in May the lowest number of attacks and deaths for the year was reached. It was hoped at the beginning of June that the epidemic would be entirely got under, but the disease increased in June in the Lingsugur district, and in the same month the district of Gulburga was infected from the little state of Akalkote. In July the epidemic had thoroughly revived in both districts, and it continued to increase until September. In October, November and December it declined again. The total number of cases was 7,887 against 4,475 in the previous year. On the 1st of January, 1899, there were 27 villages infected with plague in the Nizam's dominions. Nine of these were situated in the zilla of Naldrug, adjoining the British collectorate of Sholapur. Eighteen villages were infected in the Lingsugur taluq, adjoining the British collectorates of Bijapur, Dharwar, and Bellary. The infected districts were therefore 200 miles apart, and separate plague measures had to be instituted for each. The infected villages in the Naldrug district threatened the large trading town of Gulburga on the Great Indian Peninsular Railway, and those in the district of Lingsugur the equally important railway junction of Raichur; and through these two towns Hyderabad itself was menaced. In neither place did plague effect any lodgment, though 16 cases of the disease were imported into Gulburga. There is no doubt that the reason why Gulburga and Raichur escaped was that adequate arrangements were made by the Subadar of Gulburga and the Taluqdar of Raichur to prevent its importation and spread. The total number of villages infected in the year 1899 was 186 against 71 in 1898 and four in 1897. In 1898 three villages were re-infected, and in 1899, 13. In every one of these cases the reinfection was due to re-importation, and not to the survival or revival of the old infection. The measures employed to deal with the epidemics of plague in the State in 1899 were the same as those which were successful in 1898. In the first place every infected town or village was promptly evacuated, and the inhabitants made their own arrangements for camping out in the fields. By this time it had come to be recognised by the people themselves that by evacuating their homes they left infection behind them, and they cleared out with alacrity when plague became indigenous, and were ingenious in making themselves comfortable at little or no expense in grass huts of their own construction in the fields. The villagers in the Hyderabad State are now, also, fully alive to the advantage of keeping infected persons out of their villages, and almost every village employs a sort of quarantine of its own, whereby people from infected areas are kept out of the villages until the period of incubation has passed. Inoculation with haffkinine was commenced in April, 1899, in Kuppal. It was also carried on during the year in the Lingsugur and Naldrug zillas. There were in all 4,308 inoculations, and there would have been more had not the supply of fluid become exhausted.

There is no doubt that plague infection is spread by human agency, and it was principally in this way that it was carried about from village to village in the Nizam's dominions in 1899. The infection having been conveyed into a house, says the Plague Commissioner, the house becomes infected. The virus appears to be deposited in the floors, which constitute the principal medium by which plague infection is propagated from one human being to another, as well as to animals which are susceptible to it. While there is no doubt that the germ of plague is carried about in, and liberated from, the bodies of human beings, it is still an open question as to the exact part played in the propagation of the infection by the lower animals, especially rats. Rats are very readily affected by the plague bacillus, and die rapidly when they are inoculated with it. It is not yet, however, known positively what part they play in liberating and spreading the infection.

Plague in Rajputana.—For Rajputana were returned 29 cases and 24 deaths; but it is stated that only nine attacks and eight deaths were diagnosed with certainty as due to true plague, the rest being merely suspicious cases. The cases were returned from the Jodhpur, Sirohi, Pertabgarh and Mewar States. With regard to Pertabgarh, it is mentioned in a special report that altogether the nature of the outbreak remains obscure; and it is suggested that it was perhaps epidemic sore throat accompanied by enlarged glands, such as occasionally occurs in oriental villages, the result of bad water and insanitary surroundings.

Only one case, an imported one, was reported from Ajmer-Merwara.

Plague in Berar and in Central India.—The first case in Berar was imported from Ahmednagar. A female passenger alighted at the Mana railway station, and travelled by cart into Amraoti town, arriving there on the 3rd September. The case was discovered, segregated, and treated. The woman died on the 6th. All necessary precautions were promptly taken both at Mana and at Amraoti, and the disease did not spread. The second case, a suspicious one in the town of Amraoti, also proved fatal in the same month. Arrangements for the inspection by hospital assistants of passengers alighting at railway stations were in force during the year.

The two cases that occurred in Central India were imported from British territory. They were segregated, and no spread of the disease followed.

Plague in Burma.—The regulations regarding the medical inspection of incoming vessels from plague-infected localities were carefully carried out, and all cases of fever and suspicious cases generally were segregated under observation till their temperatures became normal. Two cases of plague were removed from vessels, the first from the s.s. "Buldana," from Bombay, in the person of the ship's cook. This vessel carried no passengers. The man was removed to the plague hospital, died, and was cremated. The vessel was thoroughly disinfected, and quarantined for ten days. The second case was that of a follower of the West Riding Regiment which arrived in Rangoon from Bangalore on the 17th October. A follower found with high fever was detained under observation, and the regiment allowed to disembark. Later on plague symptoms developed, and the man died in the plague hospital, where he was cremated. As soon as the case was pronounced one of the plague the troops and followers were at once segregated in camp and the vessel disinfected and quarantined. No other case occurred.

Fevers.

The fever-mortality ratio of India for 1899, though below that of the quinquennium, was somewhat above that of 1898; and the number of deaths rose from 3,868,781 to 4,126,384. The maximum months of death were December, November and October, and the minimum month February. There was a reduction in the number of deaths in each of the first three months of the year, and an increase in each of the other months. Though five provinces had ratios greater than in the preceding year, only two had mortalities higher than the quinquennial ratios. The highest ratio was that of the North-Western Provinces and Oudh. The greatest reduction from the quinquennial mortality was in the Central Provinces, and the greatest increase in Ajmer-Merwara.

The following table shows the mortality from fevers in different provincial registration areas of India in 1899 month by month :—

Statement showing the deaths from Fevers registered in the different Provinces by Months during the year 1899.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1899.	1899.	1898.
Bengal	145,472	99,088	103,985	115,562	132,290	96,281	109,193	134,114	126,143	178,078	186,612	180,481	1,607,279	22·61	19·97
Assam	8,578	7,448	7,563	7,131	8,199	7,597	7,121	7,146	6,827	7,526	7,930	8,030	91,096	18·04	20·90
North-Western Provinces and Oudh.	89,056	76,042	82,617	100,729	112,680	97,906	84,381	118,712	132,945	122,359	114,282	113,551	1,245,260	26·55	22·67
Punjab	34,601	28,242	29,286	27,613	32,950	28,869	26,618	35,140	32,883	33,128	36,072	36,287	381,689	18·57	20·35
Central Provinces*	12,737	11,737	14,989	18,046	15,058	13,409	10,692	11,527	11,956	11,729	10,528	11,239	153,647	16·17	16·40
Berar	3,231	2,849	5,398	6,012	5,699	4,077	3,277	3,804	3,358	3,761	3,963	4,506	49,938	17·50	11·49
Lower Burma	4,152	3,937	3,934	3,838	3,695	4,344	5,267	4,988	4,219	4,081	4,245	4,477	51,177	11·47	11·90
Upper „	687	1,057	2,022	2,154	1,586	1,761	1,736	1,645	1,347	1,494	1,787	2,130	19,406	7·91	*
Madras Presidency	21,045	17,778	17,886	17,622	20,971	20,325	20,744	20,199	20,297	21,109	23,331	24,242	245,549	7·32	7·48
Bombay Presidency	23,639	19,949	23,269	18,694	16,059	14,554	15,344	16,495	15,878	18,541	20,688	25,328	228,438	12·14	11·49
Ajmere-Merwara	859	902	1,295	1,065	1,050	689	777	1,153	815	935	1,301	1,864	12,705	23·42	16·02
Coorg	337	270	281	259	330	462	487	351	346	277	248	350	3,998	23·10	27·02
Mysore	4,074	2,865	2,653	2,617	2,986	3,032	3,047	2,873	2,590	2,606	3,279	3,580	36,202	7·47	11·37
Total	348,471	272,144	295,178	321,342	353,533	293,306	288,884	358,147	359,604	405,624	414,266	416,065	4,126,384	16·69	17·35

* Excluding Zamindaris.

It seems strange that so many as six out of the 13 provinces should have had the rural mortality lower than the urban; probably the rural registration was at fault. But, at the same time, the highest provincial rural mortality registered was that of the North-Western Provinces and Oudh, which usually have the rural mortality below the urban. The highest district ratio in India was that of Goella in Ajmer-Merwara, and it also showed the highest increase over the ratio of the preceding year. The greatest percentage of rural districts with high mortality was in the North-Western Provinces and Oudh, and the same administration had also the greatest percentage of towns with high mortality, as well as the highest general urban mortality in India. The town with the highest ratio and with the greatest increase over the previous year was Umarkot in the Bombay presidency. From fevers there were seven deaths among the European seamen in the port of Calcutta, six from enteric and one from malarial fever, and 37 among the native floating population. Similar statistics for Bombay are not forthcoming. In the city of Bombay relapsing fever was present throughout the year.

Sale of quinine at Post Offices.—In Bengal there was an increase in the number of quinine five-grain pice packets sold during 1899 to the extent of 859,146, against a considerable falling off in the two years preceding. This is considered to have been most probably due to the greater prevalence of fever almost all over the province. In 29 out of the 39 districts which returned a higher mortality from fever there was a corresponding increase in the sale of quinine. The sale of quinine was larger during every month of 1899, except January; the total sale for the year being 3,337,236 five-grain pice packets.

In Assam, as might have been expected, owing to the improved general health, the sale of quinine through the agency of the vaccination and post office staff fell off considerably, 2,286 packages against 3,750.*

At post offices and by vaccinators in the North-Western Provinces and Oudh were sold 136,982 pice packets. Yet the largest amount of quinine sold in any district amounted to but something under 62 grains for each thousand of the population.

Mention is made of gratuitous distribution of quinine in the Punjab districts of Dera Ghazi Khan, Dera Ismail Khan and Hoshiarpur. The Civil Surgeon of the last named district stated that the experiment of selling quinine in pice packets had proved a failure.

The Central Provinces, Berar, Bombay and Madras do not appear to have furnished particulars of quinine sales, if such there were.

By the post offices in Coorg 23,218 powders were sold, nearly one-third less than in the preceding year. On the 26th of December, 1897, the price of one powder was raised from two pies to three pies, and to this the Civil Surgeon principally attributes the great falling off in the demand for quinine powders.

The Sanitary Commissioner states that the scheme for the sale of quinine in the interior of Burma does not appear to have achieved much success. The Burman villager is said not to appreciate quinine; and though some are willing to use the drug if given to them, yet few wish to buy it, preferring their own remedies. In some instances Deputy Commissioners reported that the use of the drug was unpopular, and recommended that the scheme should be given up altogether. The Sanitary Commissioner, however, thinks that it would be a pity to abandon it without further trial, and without further endeavour made by the district authorities to popularize the drug.

Remarks by provincial Sanitary Commissioners.—Of the remarks made on the subject of fevers by the Sanitary Commissioners of the various provinces the following are some of the most interesting:—

Bengal.—The Civil Medical Officer of Malda says:—"The marshes are the unhealthiest features of the district. If fever is to be combated, these should be reclaimed. They should be drained dry and made to grow not rice but wheat, a dry crop and not a wet one. With the marshes the miasmata will disappear, and with wheat health will appear; for in a malaria-stricken country rice as a staple article of food should be eschewed." The Civil Medical Officer of Dinajpur is of opinion that the chief cause of the fevers is malaria due to excessive sub-soil moisture; and states that in his district there are about 674 square miles of marsh land, about one-sixth of the entire area. At Murshidabad, Rajshahi and Faridpur it appears that the want of sufficient rainfall and of floods at places during September and October, by failing to wash away impurities and wash out tanks and other sources of water-supply, seems to have generally rendered the last quarter of the year most unhealthy.

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* *i.e.*, probably 233,172 and 382,500 five-grain pice packets.

Assam.—The number of deaths from the fever known as *kala azar*, district by district, and year by year, is shown in this table :—

Districts.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
1	2	3	4	5	6	7	8
Cachar	2	1	—	1	—	—	1
Sylhet	30	2	9	4	—	3	—
Goalpara	623	384	265	298	232	134	161
Kamrup	2,490	2,149	2,059	2,244	2,756	1,693	1,745
Darrang	1,620	1,992	2,477	2,471	3,597	4,113	4,101
Nowgong...	5,407	8,585	11,037	10,588	12,102	10,515	8,192
Sibsagar	1	2	5	4	2	9	8
Lakhimpur	50	36	30	16	12	3	3
Nagar Hills	—	—	—	—	—	—	—
Khasi and Jaintia Hills (selected areas) ...	24	13	12	11	1	2	5
Garo Hills (selected areas)	—	—	—	—	—	—	30
Total	10,247	13,164	15,891	15,637	18,612	16,472	14,246

On the whole, the epidemic may be said to be surely, if slowly, ceasing; but whether it will disappear without infecting the Sibsagar and Lakhimpur districts is more than any one can predict. The Deputy Commissioner of Sylhet made some inquiries as to the prevalence of the fatal fever called "*mulki pira*" in allusion to the way it spreads over the country, or "*pet mota*" from the enormous enlargement of the spleen which characterizes it, a fever which has been severe for the last two or three years in the tract between Sylhet and Fenchuganj and Balaganj . . . In my opinion these cases must be considered as *kala azar*, as I am not acquainted with any other kind of fever which produces such symptoms and results. The Deputy Commissioner got one village to remove to a new site in the open fields, to try if this would stop the effects of "*mulki pira*"; the villagers stated that they had lost numbers in the last three years, but that since removal to their new site the disease had almost disappeared.

Punjab.—There was no unusual rise in the mortality during the autumn months. This was due undoubtedly to the dryness of the season, being the result of failure of the monsoon, the rainfall registered in the third quarter of the year being only 7·77 inches against an average of 17·53 for the preceding ten years. It is probable that many deaths registered as "fevers" are caused by influenza.

Berar.—The increase was general in all districts . . . Influenza, which was very prevalent in 1899 as compared with 1898, especially at the end of the cold and commencement of the hot weather, served to increase the mortality under this head.

Madras.—The rate was the smallest recorded since 1883. Unfortunately it cannot be assumed that this is due to any striking measures taken for the reduction of malaria. Quinine has been successfully issued at post offices, and there have not been wanting those who have hunted the *anopheles:* but no great measures that would effect removal of superfluous mosquitoes, or moisture that would encourage their existence, from large areas, have yet been carried out. Rather must the reduction be regarded as due to the imperfect character of the north-east monsoon failing to bring with it the essential presence of moisture in the soil, and to the not insignificant influence of a desire on the part of those registering deaths to escape suspicion of a disease whose prominent symptom is fever, namely, plague. Although it is well known that the majority of these "fevers" are of malarial origin, doubtless phthisis, pneumonia, pleurisy, affections of the liver, and diseases generally where fever is the prominent symptom are included under this rough head . . . Some effort is being made to secure a better approach to accuracy in municipalities . . . There is no lack of instances in this presidency where a locality in which mild fever has existed has been converted into a deadly malarious place by introduction of superfluous water for irrigation purposes, and there are instances where limitation of irrigation has been followed by beneficial results, but none where extensive works of drainage have secured the admirable curative influence obtained in other countries . . . During the year Major Grant, I.M.S., Professor of Hygiene, invited attention to the severe nature of malarial fevers found in Madras town . . . Not only does malaria exist in Madras itself, but intense forms are to be found within seven miles of it at Ennore—a once favoured health resort, in which disturbance of sub-soil and surface water was brought about by railway and canal configuration. In 1896 I spent several days here, and obtained ample microscopical evidence of the presence of the *plasmodium malariæ* in its various forms, in subjects who had indubitably acquired the disease locally. It must not, however, be considered that malaria is the sole cause of fever in Madras town. Typhoid fever is by no means uncommon. Phthisis and low forms of pneumonia are prevalent among the poorer classes. There are doubtless also hitherto unclassified fevers to be demonstrated by the observer of the future.

Burma.—It is usual for the mortality from fevers in rural circles to exceed that of town circles, the explanation being that dwellers in the country are more exposed to malarial influence than the residents of towns . . . Swampiness and various other sanitary defects are noted by the Civil Surgeons of the five towns in which mortality was above the average under this heading. . . . Though the term "fever" covers a multitude of complaints in which a rise of temperature occurs, and deaths other than those due to malaria are often registered under this heading, still, as similar errors in classification occur pretty equally in all districts, the deaths recorded under "fevers" may, for purposes of comparison, be regarded as of malarial origin, as doubtless the majority of them are, and may be taken as a test of the malaria-producing condition of the tract of country to which they refer. For the five years 1894–98 the fever death-rate of Burma was, next to that of Madras, the lowest in India.

Dysentery and Diarrhœa in India.

The mortality ratio for bowel-complaints for India, though lower than the quinquennial figure, was higher than in 1898, and the number of deaths rose from 216,321 to 252,025. The maximum month of death was August, and the minimum February. January and February showed a decrease, all the other months an increase as compared with the corresponding months of the year before. All the provinces but three had higher ratios than in 1898, but only five had ratios higher than the quinquennial mortalities. Much the highest ratio was that of Berar, and next came the ratios of Bombay and Assam. The greatest reduction from the quinquennial mortality was in the Central Provinces, and the greatest increase in Ajmer-Merwara; exactly as was the case with fevers.

The following table shows the mortality from dysentery and diarrhœa in the different provincial registration areas of India in 1899 month by month :—

Statement showing the deaths from Dysentery and Diarrhœa registered in the different Provinces by Months during the year 1899.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL. 1899.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1899.	1898.
Bengal	3,597	2,787	2,715	3,055	3,888	2,831	3,444	3,805	3,343	3,964	3,756	4,149	41,334	0·58	0·52
Assam	1,193	879	919	885	979	1,132	980	1,100	1,324	1,538	1,482	1,424	13,835	2·74	3·23
North-Western Provinces and Oudh.	1,733	1,261	1,407	2,081	2,912	2,772	2,377	2,874	2,803	2,455	2,365	2,166	27,206	0·58	0·50
Punjab	746	548	633	966	1,175	949	1,047	1,618	1,503	1,482	1,393	1,350	13,410	0·65	0·77
Central Provinces*	750	688	880	855	946	1,056	1,132	1,382	1,216	1,064	930	986	11,885	1·25	1·23
Berar	973	797	1,222	1,194	1,593	1,422	1,862	2,551	2,283	2,122	1,914	2,330	20,263	7·10	3·48
Lower Burma	393	430	579	711	801	929	1,170	827	660	572	499	509	8,071	1·81	1·78
Upper Burma	34	67	90	97	215	287	318	297	199	109	73	65	1,851	0·75	*
Madras Presidency	3,395	2,572	2,201	2,110	2,322	2,420	2,379	2,423	2,600	2,893	2,990	3,002	31,307	0·93	0·89
Bombay Presidency	5,729	4,556	5,473	5,200	5,510	5,699	7,602	7,781	7,105	6,736	6,102	7,243	74,736	3·97	3·02
Ajmere-Merwara	45	41	50	69	41	38	71	172	78	107	147	300	1,159	2·14	1·01
Coorg	12	2	3	7	4	15	19	13	12	11	8	4	110	0·64	1·09
Mysore	741	582	568	517	613	496	550	537	533	606	537	578	6,858	1·41	1·39
TOTAL	19,341	15,210	16,740	17,747	20,999	20,046	22,951	25,380	23,659	23,659	22,198	24,097	252,025	1·14	0·99

* Excluding Zamindaris.

Only in Berar was the rural mortality higher than the urban; and in this province both the rural and the urban mortality were the highest in India. The highest district ratio of India was that of Akola in Berar; but among maximum district ratios the greatest increase over the ratio of the previous year was in Jassakhera in Ajmer-Merwara. The greatest percentage of rural districts with high mortality was in Berar, 100 per cent. The town with the highest ratio and with the greatest increase of ratio was North Lakhimpur in Assam. The greatest percentage of towns with high mortality was in Berar and Assam. In the port of Calcutta there were three deaths among European seamen, and five in the native floating population. There are no corresponding figures at hand for Bombay.

Remarks by provincial Sanitary Commissioners.—Some of the more important remarks of the Sanitary Commissioners of the various provinces on the subject of bowel-complaints are as follows :—

Bengal.—The increased prevalence of dysentery and diarrhœa was probably due to some extent to the causes which led to increased cholera in many districts, viz., early cessation of the rains and the early pollution of the water-supply . . . The intensity of the disease was as usual much greater in towns than in rural areas. This seems to be chiefly due to overcrowding and and its attendant evils, which are more intense in towns than in the open country; and also to the greater probability of the disease being correctly diagnosed and reported in towns.

Assam.—The district rates present the same extraordinary and unaccountable differences as in former years. The difference must, I think, be more apparent than real, and be caused by differences in registration. I cannot believe acute bowel-complaint to be more than 23 times as common in Lakhimpur as in Goalpara.

Berar.—The deficient and impure water-supply would account generally for the increase in this disease.

Madras.—The highest proportion of mortality for districts from this cause was, as usual (if the town of Madras be excluded), in Chingleput. It is presumed that, in addition to the usual causative agents of dysentery and diarrhœa, there exists in that district a favouring cause in the brackish water used by a considerable proportion of the population. The towns which returned the highest mortalities are towns either where conservancy is defective, or in which the water-supply is open to contamination : and frequently these two defects are combined with a brackish condition of the water. Variations in the registered amount of dysentery and diarrhœa from year to year are brought about by the occurrence of cholera, when doubtless attempts are made to conceal the existence of this disease, or, more especially at the beginning and end of such epidemics, mistakes in diagnosis occur ; but on the whole, from year to year there is, broadly speaking, little material change of the death-rates from dysentery and diarrhœa in any special town. There is little tendency to epidemic outbreak. On the contrary, where bowel affections have established themselves they seem to claim their victims at fairly regular rates from year to year, proving that permanent, not passing, sanitary defects are at work.

Bombay.—Up to 1897 the deaths ascribed to dysentery and diarrhœa showed only comparatively slight variations, but in that year they rose from 36,046 to 85,966 ; and though they fell in 1898 to 56,789, they rose again in 1899 to 74,736 . . . The increase was most noticeable in the parts affected by famine. The collectorate of Sholápur headed the list, and ratios were also high in Khandesh, Poona, Nasik, Satara, the City of Bombay, and Bijapur. In the Gujrat District also there was an increase in every collectorate, but the figures are not high, considering that the district is famine-stricken.

Burma.—The prevalence of epidemic cholera is generally reflected in the mortality registered under diarrhœa and dysentery ; but it is to be noted that Tavoy and Thatôn returned comparatively low death-rates from cholera, so that the cause of the high mortality from bowel-complaints must be sought for in some other direction.

Injuries.

The recorded deaths from injuries rose to 98,593 from 95,291, and the ratio to 0·45 from 0·44. There was an increase in the number of deaths from the attacks of snakes and wild beasts, and from injuries other than the suicidal, there being a decrease in suicide. The increase of mortality from total injuries was greatest in Madras and Bengal. The Sanitary Commissioner of Bengal says :—

> The disastrous floods which occurred in the Godda Subdivision of the Sonthal Parganas and in the eastern portion of the Bhagalpur district on the night of Sunday, the 24th September last, and the terrible landslip at Darjeeling about that time, are responsible for the increased mortality from "accidents." It is curious that while the total number of suicides committed from year to year is pretty constant among both sexes, nearly twice as many females every year perish by this means as males. This, however, is quite opposed to facts observed in England and Scotland, where a much larger number of males than females—nearly thrice as many of the former as the latter—resort to self-destruction. As compared with the women of Great Britain, the women of this country occupy a lower position in society, and their grievances are believed to be many, while political and mercantile excitement and dearness of food that are such potent causes of suicide in Great Britain are, especially the first two, almost absent in this country.

It is noted that the districts of Azamgarh, Hardoi, Farakhabad, and Shahjahanpur in the North-Western Provinces and Oudh, and of Gurgaon in the Punjab, have usually the largest number of suicides in their respective provinces. In the Punjab there were 111 deaths from hydrophobia, against 147 in the previous year. In the Bombay report it is mentioned that deaths from snake-bite were, as usual, most common in the rains. In the Central Provinces arrangements have been made to have the necessaries for the antivenene treatment ready at all dispensaries.

All other Causes.

There was an increase in the number of deaths registered under the heading "all other causes" from 1,376,725 to 1,748,689, and in the ratio from 6·31 to 7·92. The extent to which plague is, either openly or for purposes of concealment, included under this head, varies in the different provinces. The Sanitary Commissioner of Bombay is inclined to think that a new column should be added to the registers for diseases of the respiratory organs. The greatest increase was in Berar, Bombay, and the Central Provinces. In Bombay the increase is ascribed to better registration.

Vaccination.

The work of the Vaccination Department in India during the year 1899–1900 is represented by a total of 8,125,337 operations among the civil population of the country. This must be considered a satisfactory result, as it indicates a return to ordinary conditions after the considerable decline exhibited in the returns of the two preceding years. The aggregate number which stood at 8,019,836 in 1896–97, fell to 7,829,983 in 1897–98, and still further to 7,515,527 in 1898–99, owing mainly to the presence of plague and famine. The directions in which these causes operated need not be discussed here at length, but it is obvious that famine, by raising the death-rate of infants and by lowering the birth-rate, leaves less material to work upon ; and as regards plague, its actual presence and the fear of its invasion not only diverted the services of officers and subordinates to other pressing work, but it gave rise among the people to unfounded fears that vaccination was being used as a cloak for anti-plague inoculation. Plague unfortunately is still amongst us, but the dread it inspired has greatly diminished, and the measures for its suppression are generally accepted with more or less equanimity. A striking instance of the returning confidence of the people is afforded by the year's work in the small province of Coorg, where operations returned to the normal after having fallen off 50 per cent. the year before ; elsewhere a similar experience is afforded, if not in such marked degree.

The numbers of both primary cases and re-vaccinations show an increase, the aggregate excess over the figure of the preceding year, amounting to 609,810 cases, being contributed to in varying measure by all the provinces without exception. Of primary operations there were 7,500,113 against 6,931,793 in 1898–99, and of re-vaccinations 625,224 as compared with 583,734. The degree of success secured in the former rose to 94·63 per cent. from 93·87 per cent. in 1898–99, but in re-vaccinations, on the other hand, it fell from 63·71 to 58·76 per cent. ; this is less a matter for regret if it connotes the increasing efficacy of primary operations and a higher standard of work and verification.

In regard to primary vaccination, the degree of success secured by the special staffs in the several provinces varied greatly ; Ajmer-Merwara heads the list with 99·08 per cent., followed by Assam with 98·81 ; while Madras takes the lowest place with 91·8 per cent., the Bombay results, which are the next lowest, being 92·68 per cent. In re-vaccination the range is still greater, and while Ajmer-Merwara again occupies the first place with 90·83 per cent. of success, the next in order is Assam with 88·56, until we come to 40·39 in Bombay and only 17·2 in Berar. As has been pointed out in previous reports, extreme differences in results must be due in the main to divergence in the interpretation of the term " successful." Enquiries instituted to elucidate this point have shown that such is actually the case, the rank and file of the Department exercise too little discrimination, and, in practice, use a very varying standard in determining this important but simple question. It goes without saying that the standard for both primary operations and re-vaccinations should be one and uniform, and steps are being taken to ensure this in future, as at present the results are not comparable, and are indeed often incomprehensible.

The staffs of the dispensaries conducted vaccination operations in all the provinces save in Berar and Ajmer-Merwara, and the success secured by them ranged, in primary cases, from 97·25 per cent. in the North-Western Provinces and Oudh to 66·57 per cent. in the Punjab, and in re-vaccinations from 92·19 in Assam to 48·83 in Bengal. As a natural result of the increased total of operations performed during the year, the ratio of persons who may be regarded as protected from small-pox rose from 30·26 per 1,000 of population in 1898–99 to 32·86 in the year under report. These figures are, however, necessarily only approximate, as the population must have generally increased since the census of 1891, the figures of which are used in the calculation. The provincial ratios of population protected ranged from 56·72 in Burma and 54·70 in Coorg to 29·49 and 28·72 in the Bombay and Madras Presidencies, respectively. Berar again heads the list as to the average number of operations performed by each vaccinator, the number having risen from 3,020 in 1898–99 to 3,997 ; the Punjab comes next with 3,150 ; Bengal again returns the lowest figure, viz., 596, which is an increase of 10 on the result of the preceding year. In Berar rewards varying in amount from Rs. 45 to Rs. 20 were given to six vaccinators in recognition of the excellent work performed during the year, which was far above the average.

With the increased outturn of the work by the Department, the number of children under one year of age successfully vaccinated increased in every province as compared

with the results of the preceding year. The aggregate number amounted to 3,462,702 as compared with 2,815,592 and 2,853,132 in 1897–98 and 1898–99 respectively. Assuming a hypothetical birth-rate of 40 per 1,000 of the population, the protection afforded to infant life is represented by a ratio of 38·11 per cent., while in the two years immediately preceding it was 31·37 and 30·95 ; this ratio ranged from 83·00 in Berar, where it was also highest in 1898–99 with 60·31 per cent., to 11·70 in Coorg, which also occupied the last place in the preceding year with 7·38 per cent. The total number of children between the ages of one and six years successfully vaccinated again showed a fall ; in this report for 1898 it was noted that the number had declined from 3,172,881 in 1897–98 to 3,008,037 in 1898–99, while in 1899–1900 it was 2,990,364. The decrease occurred in all provinces save the Punjab, Madras, Coorg and Ajmer-Merwara, and is probably to be attributed to the increased infantile mortality due to scarcity and famine, and to a lower birth-rate in 1896 and 1897.

The ratios of deaths from small-pox in the calendar years 1898 and 1899 were 0·26 and 0·23 respectively per 1,000 of the population. No marked epidemic during the year under report (1899) was traceable to inoculation, which appears to linger in Bengal, Assam, the Punjab, Bombay and Burma, but is only general throughout the last-named province, and in Assam is said to be fast dying out.

The following statement shows in outline the working of the Department in the several provinces during the two years 1898–1899 and 1899–1900, *i.e.*, the year under report and that preceding it :—

Comparative statement of Vaccination in the different Provinces of India, in 1898–1899 *and* 1899–1900, *together with the death-rates from Small-pox during* 1898 *and* 1899.

PROVINCE.		Population.	NUMBER OF VACCINATIONS PERFORMED.			PERCENTAGE OF SUCCESSFUL CASES.		Persons successfully vaccinated per 1,000 of population.	Ratio of deaths from small-pox per 1,000 of population during the calendar years 1898 and 1899.*	Average number of vaccinators employed in Department.†	Average number of operations per vaccinator.†
			Primary.	Re-vaccinations.	TOTAL.	Primary.	Re-vaccinations.				
Bengal	1898-1899	71,092,411	2,087,285	60,167	2,147,452	97·99	67·35	29·34	0·20	3,482	586
	1899-1900	70,974,023	2,203,984	48,537	2,252,521	97·68	49·59	30·67	0·18	3,592	596
Assam (including tea gardens)	1898-1899	5,634,258	237,088	21,817	258,905	98·35	93·78	45·02	1·03	219	981
	1899-1900	5,716,833	255,131	17,134	272,265	98·50	88·90	46·62	0·31	220	988
North Western Provinces and Oudh	1898-1899	47,146,033	1,340,561	58,665	1,399,226	91·58	71·22	26·93	0·05	875	1,598
	1899-1900	47,146,033	1,450,544	61,813	1,512,357	94·23	76·53	29·99	0·04	898	1,683
Punjab	1898-1899	20,553,982	667,518	177,558	835,076	94·85	58·69	35·41	0·24	297	2,808
	1899-1900	20,553,982	738,669	194,554	933,223	94·67	62·29	39·92	0·25	296	3,150
Central Provinces ..	1898-1899	12,900,386	383,633	65,617	449,250	95·92	81·77	32·69	0·10	274	1,588
	1899-1900	12,739,620	456,857	52,466	509,323	96·33	82·05	37·92	0·11	274	1,767
Berar	1898-1899	2,897,040	94,032	38,871	132,903	97·1	23·1	34·6	0·2	44	3,020
	1899-1900	2,897,040	120,772	55,129	175,901	95·8	17·2	43·2	0·1	44	3,997
Burma	1898-1899	8,146,855	447,259	33,398	480,657	94·60	60·13	51·41	1·07	177	2,635
	1899-1900	8,146,855	462,795	40,719	503,514	94·65	59·08	56·72	1·49	188	2,611
Madras	1898-1899	35,651,577	1,039,713	78,280	1,117,993	87·22	68·67	26·94	0·6	818	1,330
	1899-1900	35,651,577	1,096,821	62,588	1,159,409	89·40	69·33	28·72	0·5	824	1,375
Bombay	1898-1899	22,612,220	622,095	48,349	670,444	92·75	57·25	26·74	0·10	434	1,539
	1899-1900	22,612,220	680,063	89,294	769,267	92·60	41·62	29·49	0·10	434	1,763
Coorg	1898-1899	173,055	4,793	880	5,673	92·13	77·50	29·46	0·13	9	587
	1899-1900	173,055	8,400	2,077	10,477	94·21	74·72	54·70	0·16	9	1,110
Ajmer-Merwara ..	1898-1899	542,358	17,816	132	17,948	98·46	65·15	32·50	0·75	13	1,380
	1899-1900	542,358	26,077	1,003	27,080	99·08	90·83	49·32	1·77	13	2,083
TOTAL	1898-1899	227,350,175	6,931,793	583,734	7,515,527	93·87	63·71	30·26	0·26	—	—
	1899-1900	227,153,596	7,500,113	625,224	8,125,337	94·63	58·76	32·86	0·23	—	—

* Calculated on the figures taken from the Sanitary Reports.

† Refers to special Vaccination Establishment only.

Animal Vaccination.—During the year bovine lymph, either pure or in combination, was used in all the provinces, humanised lymph being resorted to in addition only in the

Punjab, the Central Provinces, Burma, and the North-Western Provinces. It may be noted that no precise information is afforded as regards the lymph used in the Bombay Presidency, except that animal lymph was exclusively used in Bombay City, and also in certain places in the Western and Central Registration Districts and in some Native States. The obvious disadvantages attending the use of human lymph is recognised in Burma, and orders have been issued for its discontinuance as far as possible.

Glycerinated lymph appears to have met with marked success and is used exclusively in Assam, where its results are remarkably good. This lymph is also used in Bengal, the Central Provinces, and Madras. As regards the last province, it is said that glycerine is employed more as a diluent than a preservative, and that to secure the best effects it is necessary to use the combination fresh and as soon after preparation as possible. The percentage of success secured in rural areas, 88·5, against that in towns, 95·2, is instanced in support of this contention, and it is held that glycerine paste gives results approximately equal to those of fresh animal lymph if used when quite freshly prepared, but that the results are inferior in proportion to the delay which may occur in its use. Against this, it was found in Assam that such lymph, kept for over six months, was as efficacious as at the time of manufacture. But it should be noted that in Assam the vaccine matter is scraped from the abdomens of the vaccinifers and pounded up with a mixture of glycerine and water in the proportion of two parts of solid matter and one part each of glycerine and water, and put up in capillary tubes which are hermetically sealed by fusing their ends in the flame of a spirit lamp; this procedure tends to maintain the potency and to obviate the contamination of the lymph with extraneous micro-organisms. Details of manufacture are doubtless all important to the results secured, and certainly the Shillong lymph has passed out of the stage of trial into that of well-approved excellence. It is of interest to note that a supply of two thousand tubes was set aside from the vaccine manufactured in February, 1900, for an experiment during the season 1900–1901, to determine if the lymph will keep its properties unimpaired through a hot weather in the plains, and the result will be awaited with the interest its importance demands.

As regards the Central Provinces, it was noticed in this report for 1898 that the use of glycerinated lymph had not been attended with success. At the instance of the Sanitary Commissioner with the Government of India, a further trial was made during the year under review, with more satisfactory results, the percentage of success secured having been 86·27, as compared with 72·69 in 1898–1899. Hence it is probable that in the essential details of preparation something was wanting which experience has supplied.

In Berar only lanolinated lymph was used, the year's work being started in September 1899 with a supply obtained from Mysore. Owing to the famine, healthy calves could not be obtained in sufficient numbers to carry on calf vaccination, and the only alternative was that resorted to. But to obtain the total requirements of lanolinated lymph from Mysore would have proved unduly costly, and it was therefore decided to manufacture it at Amraoti. This arrangement contributed largely to increase the amount of work done, as it obviated the necessity of taking vaccinated calves from one place to another, but it had also the result of reducing the degree of success attained. This decrease is attributed to (1) the lanolinated lymph containing proportionately less vaccine than pure calf lymph, and (2) to the locally manufactured lymph losing its efficacy according to the distance it is sent, with the delay and exposure involved. Although the expedient was necessary in an emergency and is creditable to the Sanitary Commissioner, pure calf lymph is to be reverted to as soon as circumstances permit. Lanoline lymph was also used to some extent in Bengal, the Central Provinces, and the North-Western Provinces, but the results are not stated.

Vaseline lymph appears to be used only in the Punjab; the Deputy Sanitary Commissioner is of opinion that there is no doubt as to the efficacy of this paste in producing scars that present that foveated appearance which is maintained to be the best test of efficient protection.

Generally, then, it will be seen that bovine lymph, either pure or in some combination, is fast displacing humanised lymph, and it may be hoped that in a comparatively short time the latter will find no place in vaccination operations.

For the rest some details of the comparative results of the use of bovine lymph and its various combinations will be found in the following paragraphs which deal with the details of vaccination in the several provinces.

Bengal.—The Sanitary Commissioner was, as usual, in charge of the Vaccination Department during the year 1899–1900. The staff employed under him comprised three Deputy Sanitary Commissioners, the 48 civil surgeons employed in the province, 207 native supervising officers, and six head vaccinators ; and working under this controlling agency were 65 vaccinators employed by Government, 87 by district boards, 245 by municipalities and at dispensaries, 3,440 licensed vaccinators and 1,199 apprentices. It should be noted that though the Western Bengal Circle was in charge of an assistant surgeon throughout the year as Deputy Sanitary Commissioner, the Northern Circle was without an inspecting medical officer from the 1st April to 28th December, 1899, the Sanitary Commissioner himself attending to the current duties of this office in addition to his own. Moreover, the three officers appointed to the Metropolitan and Northern Bengal Circles were otherwise employed, two of them on plague work, and one on an inquiry into the sanitary condition of the riparian municipalities north of Calcutta. As a consequence of these special calls these officers were unable to inspect vaccination work.

Throughout the province the total number of operations performed was 2,252,521 as compared with 2,147,452 during the preceding year, an increase of 105,069 operations ; but with this increase on the provincial total there was a decrease in the number of operations in 21 districts, the chief causes alleged being the prevalence of cholera and malarial fevers of a fatal form ; the decrease ranged in different places from 9,243 in Dinajpur to 302 in Angul. On the other hand, there was a notable increase of 26,222 cases in Mymensing, and of 23,526 in the Sonthal Parganas.

Over the whole province the number of primary operations was in excess of that of the preceding year to the extent of 116,699 cases ; the number of successful results was 2,152,824 as against 2,045,384 during 1898–99, an increase of 107,440 ; but the ratio per cent. of success was 97·67, being slightly less than that attained in the year preceding, when it was 97·99.

In 1898–99 the number of successful re-vaccinations reported was 40,520, which showed a decrease on the results of 1897–98 of 8,687 operations. There was a still further fall during the year under review to a total of 24,071, and the percentage of success was only 49·59 against 67·34 in 1898–99.

No satisfactory explanation has been furnished of this large decrease, and as regards Dinajpur where the falling off is most marked, the civil surgeon merely attributes it to the unwillingness of the people to submit to re-vaccination.

With regard to the vaccination of infants, the hypothetical birth-rate has, in accordance with the orders of the Local Government, been taken at 50 per 1,000 of the census population, though elsewhere the accepted rate is 40 per 1,000, and this has necessarily reduced the calculated proportion protected to 16·79. But taking the birth-rate as in previous years at 40 per 1,000, the degree of infant protection afforded was 21·81 per cent. as compared with 17·66 per cent. in the year preceding, and 16·7 the mean of the three years 1895–96 to 1897–98.

The Sanitary Commissioner notes that the results in the municipalities are unsatisfactory, considerably less than half the available number of infants being protected, and in spite of the fact that the Compulsory Act is in force.

The average number of persons vaccinated by each vaccinator was 596 against 586 in the preceding year, an increase of 10, but considerably less than the figure for 1897–98, when it was 650.

The Deputy Sanitary Commissioners of the Metropolitan and the Eastern Bengal and of the Northern Bengal Circles, being unable to devote any time to the duty as already explained, the work of inspection by these officers could not be undertaken. In Western Bengal the Deputy Sanitary Commissioner found 97·61 per cent. of the operations inspected to have been successful, but the number inspected was only 2·25 per cent. of the number performed. In five districts the number of cases inspected by civil surgeons exceeded 10,000 in each, an amount of supervision which was only accomplished in two districts in 1898–99 ; in nine districts, as compared with seven in the previous year, between 5,000 and 10,000 cases were inspected. In six districts, against four in the preceding year, there were less than 1,000 inspections made. The percentage of operations to the total performed, inspected by civil surgeons was, however, 9·30 against 8·51 in the previous year, and this is nearly equal to the result in 1897–98, when it was 9·34. District and sub-inspectors inspected 39·29 and 64·65 per cent. of the total performed as compared with 39·70 and 67·8 in 1898–99.

As noted in last year's report, direct calf-to-arm vaccination is steadily gaining ground ; the primary operations in 1899–1900 numbered 241,831, an increase of 35,748 over the figure for the previous year (206,083), and which was 31,082 in advance of that for

1897–98. Re-vaccinations, however, by this method numbered only 10,196, or less than half the total of the previous year, which also showed a falling off from the results of 1897–98.

A total increase of 48 is reported in the number of calves operated on at both the Calcutta and Darjeeling depôts, while the amount of lanoline paste manufactured at the animal vaccine depôt, Calcutta, increased by 2,866 grains ; the outturn of the Darjeeling depôt, however, declined to the extent of 4,247 grains. The cause of this decrease has not been stated, though the matter is of interest and importance, since the number of calves operated on at this depôt was larger by 20 than that of the year preceding, and, moreover, the supply of lanoline lymph paste from this depôt to the Sikkim State, which received 405 grains, is reported to have proved eminently successful, though the exact results have not been given.

Assam.—The staff of the Department was practically the same as in the year before, viz., 19 inspectors and 186 paid and 23 licensed vaccinators, working under the control of the Sanitary Commissioner and district civil surgeons ; the number of apprentices employed was 11 compared with 7 in 1898–99. The work of this staff was, as usual, supplemented by that of medical subordinates at and near dispensaries, and by private practitioners on tea-garden estates.

The total number of operations performed by all agencies during the year was 272,265 against a total of 258,905 last year, and of this number 255,131 were primary operations and 17,134 re-vaccinations. The percentage of success secured was 98·50 and 88·90 respectively, and the Sanitary Commissioner, who in the previous year was inclined to doubt the accuracy of these results, now practically accepts them as approximately correct, as it has been abundantly proved that the lymph supplied from the Shillong depôt is of consistently excellent quality ; this, however, does not dispose of the doubt to which the results recorded for re-vaccination is open.

Paid and licensed vaccinators and apprentices performed in the aggregate 236,031 operations against 232,419 in the previous year, and the dispensary staff 24,715 against 14,271. The percentage of success obtained in the primary cases and re-vaccinations represented by these figures was 98·81 and 88·56 respectively for the paid and licensed staff, and 97·16 and 92·19 for the dispensary establishments. This satisfactory increase on the results of the previous year was unfortunately not shared by all districts, a large and unexplained falling off having taken place in the Naga Hills and the Khasi and Jaintia Hills. Manipur and Kamrup also show a decline ; in the latter, the reason assigned is the replacement of licensed by paid vaccinators. On the other hand, the spread of vaccination in the Garo Hills is remarkable ; the number of operations in 1895–96 was 5,287, rising in 1898–99 to 15,866, until, in the year under review, no less than 28,071 cases were recorded. This is a striking evidence of what can be achieved by a zealous officer in a single district.

The Compulsory Vaccination Act continued in force in 11 towns, but the fall in the number of operations was continued, from 3,487 in 1897–98 to 3,021 in 1898–99, and to 2,752 in the year under report. No explanation of this marked decline has been afforded, but as a result of 595 notices issued there were only 22 prosecution in Sibsagar, with no convictions ; obviously such a lax state of affairs cannot be expected to improve the unsatisfactory condition of vaccination in compulsory areas.

On an estimated birth-rate of 40 per 1,000 the protection afforded to infants was 27·02 per cent as compared with 22·36 in the previous year, and 22·4 the mean of the three years preceding 1898–99. Taking the total number of successful operations, 46·62 per 1,000 of the population at all ages were protected against 45·02 in the previous year, and 49·61 in 1897–98.

The inspection work accomplished cannot be considered satisfactory, though it is recorded that district civil medical officers increased the total number of their inspections from 22,577 to 27,277. Nevertheless the percentage of cases inspected to the total number vaccinated was only 10·46 per cent. against 9·15 in the preceding year, and the increase is entirely due to the efforts of one officer. The work of the native inspecting staff leaves much to be desired, the number of inspections having steadily decreased, viz., from 150,005 in 1897–98 and 133,681 in 1898–99 to 121,660 in the year under report. The percentage to total vaccinations represented by these figures is 55·0, 54·19 and 46·65 respectively.

The percentage of successful cases approved by civil surgeons and native inspectors was 96·81 and 98·50, respectively, as compared with 95·99 and 98·73 in 1898–99.

The practice of inoculation is fast dying out, and no epidemic of small-pox was traced to its survival. Arm-to-arm vaccination has also been abandoned throughout the whole province.

The work of the animal vaccine depôt at Shillong was again attended with success, the quality of the lymph being uniformly of a very high standard. Calves to the number of 330 were inoculated and from these 317,382 tubes were loaded, the total expense incurred being Rs. 7,753. This number of tubes was somewhat less than in the preceding year when the outturn was the largest on record. An outbreak of rinderpest among the calves necessitated work being suspended for 10 days, but there was no stoppage of the supply of lymph owing to the precaution of keeping a fortnight's supply in hand.

In consequence of the success attending operations with a supply of glycerinated lymph which had been kept for six months, experiments are being made to ascertain its keeping qualities. It will be interesting and important to ascertain if lymph will retain its efficiency if kept in the plains throughout a hot weather if not exposed to sunlight, but the results will only be available for publication in the ensuing report.

North-Western Provinces and Oudh.—Vaccination operations were conducted in the united provinces, as usual, under the supervision of the Sanitary Commissioner, two Deputy Sanitary Commissioners, and 48 civil surgeons, who are styled district superintendents, and 49 native assistant superintendents, the controlling staff being thus the same as in the preceding year. The average number of vaccinators employed throughout the province was 898 or 23 more than during 1898–99.

The number of operations performed was 1,511,436 against 1,398,684 in the preceding year, an increase of 112,752, and of the total 1,449,653 were primary cases and 61,783 re-vaccinations; a satisfactory increase in both classes as compared with the work of 1898–1899. Of these 1,365,931 and 47,292 respectively were successful, the percentage of success being returned at 97·00 and 81·93 respectively, in cases in which the results were known. This is an improvement on the results for the two preceding years, viz., 94·96 and 79·76 in 1898–99, and 93·74 and 68·20 in 1897–98, in the two classes of operations respectively. The average number performed by each vaccinator was 1,683·11, a commendable increase as compared with recent years, the figures being 1,598·5 in 1898–99, and 1,598·9 in 1897–98.

At dispensaries 891 primary operations were performed with a percentage of success of 97·25, against 525 operations and 90·02 per cent. of success in 1898–99; there were also 30 re-vaccinations by this agency, with a percentage of success of 44·00 against 71·43 the previous year.

There were 853,065 infants successfully vaccinated during the year, so that taking the birth-rate at 40 per 1,000 of the census population, 45·24 per cent. were protected against 33·80 per cent. the year before, and a mean of 30·04 in the three previous years.

The Vaccination Act is in force in all municipalities and cantonments, but is enforced with a very varying degree of energy. Steps have been taken to direct the attention of the authorities concerned to the matter where necessary, and it is hoped this will have a beneficial effect where the rules are perfunctorily observed. There was, however, an increase of 14,828 successful primary vaccinations in these towns, as compared with the total for the previous year, and the proportion of persons protected rose from 33·1 per 1,000 to 37·97.

The actual total number of cases inspected by the Deputy Sanitary Commissioners and civil surgeons increased to 134,614 cases from 129,403 in 1891–99, and similarly the assistant superintendents verified 456,379 operations against 411,165. This gives a percentage to the total number vaccinated of 8·91 and 30·19 for 1899–1900 as compared with 9·25 and 29·40 in 1898–99, by the two classes of inspecting officers respectively specified. The results given show that superior inspecting officers found 96·97 per cent. successful, and inferior inspecting officers 95·08, as compared with a ratio of 96·41 per cent. claimed by vaccinators.

The lymph supply from the Almora and Garhwal depôts is reported to have been very good, while that from Tehri-Garhwal was unsatisfactory, and many tubes of the latter supply were rejected by the Deputy Sanitary Commissioner. Measures have been taken to improve matters. Besides these there were three other minor depôts at work, one each in Lucknow, Allahabad and Bahraich; the supply from the latter was good, but that issued

from the first only gave satisfactory results locally, but not so when sent elsewhere. It is suggested in explanation that the crude lymph does not retain its efficacy for any length of time under conditions of exposure.

The results of the lanoline calf lymph supplied to municipalities from the Allahabad depôt were found by the Deputy Sanitary Commissioner to be most disappointing. In this case the cause is attributed to inadequate supervision of the details of manufacture, and steps have been taken to remedy defects. The question of a central bovine lymph depôt, to be located in the hills, was still under consideration at the close of the year.

Punjab.—The strength of the Department was precisely the same as in the preceding year, and consisted of the Sanitary Commissioner, the Deputy Sanitary Commissioner, the district civil surgeons, six divisional inspectors, 24 native inspectors, and 303 vaccinators.

The total number of operations performed in the province was 943,074, an increase of 102,206 over the figures for the previous year. Of these 744,917 were primary cases and 198,157 re-vaccinations, compared with 661,937 and 178,931 respectively during 1898–99.

The district, special and cantonments staffs all show an increase in the work of primary vaccination, and the district and cantonment staffs in that of re-vaccination, compared with the results of the preceding year. The dispensary staff, however, performed less than half the number of primary operations to its credit in 1898–99, 344 cases against 808, though re-vaccinations were increased from 335 to 407.

The general provincial increase noted above is satisfactory, the total number of operations being the highest recorded for many years. The system instituted last year, by which the vaccinators work in groups instead of as isolated units, and to which, as a new departure, a falling-off in the results was attributed in the previous year, has now been developed more effectually, and appears to be fully justified. In contrast to this general improvement a decrease is noted in the work in eight districts, but this is mainly as regards re-vaccination, and various local and special conditions are declared to be responsible for what is doubtless only a temporary decline. The decrease in the work of the dispensary staff as regards primary operations is due to the fact that medical officers in charge of dispensaries are only permitted to vaccinate those who may attend for the purpose, and this number shows a tendency to diminish as confidence in the itinerant vaccinators developes.

Over the whole province the percentage of success gained in primary vaccination is recorded as 94·68, as compared with 94·84 in 1898–99; but the results attending the few operations performed by the dispensary staff exhibit a decline from 85·59 to 66·57 per cent. in 1898–99 and 1899–1900 respectively. In re-vaccinations the whole provincial percentage of success was 62·55 in 1899–1900 against 58·80 in 1898–99.

Of the Native States which maintain their own vaccination staff, eight, against seven in the year before, furnished returns; in these States 92,981 primary cases and 36,845 re-vaccinations were performed, and to these figures the Patiala State alone contributed 56,413 and 35,654 respectively. The total shows an increase of 8,434 primary operations, but a decrease of 5,661 re-vaccinations, the latter result is no doubt largely due to re-vaccinations having been suspended during the year in the Nabha and Jhind States. The percentage of success in primary cases ranged from 98·07 to 92·21, and in re-vaccinations from 100·0 in Bahawalpore and Maler Kotla, to 40·63 in Kapurthala.

On a hypothetical birth-rate of 40 per 1,000 of the census population of the province, 66·55 per cent. of the infants born were protected, an increase on the calculated results of the previous year, when the percentage was 59·97, and over the mean of the three years preceding 1898–99, which was 58·2 per cent.

The work of inspection performed by civil surgeons and native supervisors shows an improvement. The former verified 9·39 per cent. of the total primary operations, and 6·27 of the whole number of re-vaccinations, against 6·54 and 3·38 per cent. respectively in the previous year; the latter officers inspected 65·4 per cent. of the total primary cases, and 35·51 per cent. of the re-vaccinations, their figures for 1898–99 being 60·14 and 35·21 per cent. respectively. Divisional inspectors verified 16·54 and 15·73 per cent. against 17·81 and 15·29 in 1898–99. The percentages of success reported by the supervising staff were, as in the year before, in all cases higher than those reported by vaccinators.

The lymph in use was of three kinds, viz., animal, human, and vaseline paste, and the percentage of success secured in primary cases was 99·31, 99·27 and 96·81 per cent. respectively, as compared with 99·20, 99·37 and 93·6 in the preceding year. In re-vaccinations the results were: vaseline paste 80·10 per cent. against 70·92 in 1898–99

animal lymph 77·75 against 73·65, and human 68·52 against 75·71. Vaseline lymph was more extensively used and with better results than in the previous year ; it is expected that as vaccinators learn to apply this vaccine the results will improve. The deputy sanitary commissioner is carrying out experiments to determine the protective power of this compound by subsequent operations on the same subject repeated at varying intervals ; comparative results from pure bovine lymph will be ascertained.

The animal lymph depôt was located at Murree from April to October inclusive, and at Amritsar for the rest of the year, viz., November to March. Of vaseline vaccine paste, which is the only lymph prepared at the depôts, 1,847 and 3,468 tubes were manufactured at Murree and Amritsar respectively, which represents a total increase of 2,149 tubes on the outturn of the preceding year ; only 48 tubes are reported to have failed against 53 the year before. The expenditure incurred in maintaining the lymph depôt was only £51, and it is calculated that sufficient paste for each vaccination was produced at a cost of less than one pie.

Central Provinces.—The only change in the strength of the Vaccination Department in the Central Provinces was an increase of three in the number of Native Superintendents of whom there were 31. The rest of the staff consisted of the district civil surgeons and 274 vaccinators, all under the control of the Sanitary Commissioner.

The total number of operations performed during the year was 484,535, or 49,361 more than in 1898–99 ; the increase in primary cases was 65,672, but there was a decrease of 16,311 in re-vaccinations, and the difference amounts to the net increase noted.

The total of primary operations numbered 436,704 against 371,032 in 1898–99, 60,366 of the increase being apportioned to British territory, and 5,306 cases to Feudatory States. In re-vaccinations both areas exhibit a decline to the extent of 10,535 and 5,776 respectively, a total decrease of 16,311 cases, there having been only 47,831 re-vaccinations in 1899–1900 as compared with 64,142 in the preceding year.

As regards primary cases, the percentage of success in British districts was 96·65, and in Feudatory States 95·82 as against 96·82 and 92·86 respectively the year before. The results for re-vaccinations are returned at 81·32 and 92·42 per cent. in the separate areas respectively as compared with 79·15 and 95·70 in the preceding year.

The average number of persons vaccinated by each vaccinator rose creditably to 1,767 from 1,391 in 1897–98, and 1,588 in 1898–99.

The primary operations in British territory numbered in all 354,655, of which 342,782 were returned as successful, the percentage being 96·65, which was slightly less than the result secured in the previous year, when it was 96·82. Re-vaccinations numbered 41,739, of which 33,941 were successful, yielding a percentage of success of 81·32 against 79·15 per cent. in 1898–99.

In the Feudatory States primary operations amounted to 82,049, of which 78,616 were successful, compared with 76,743 and 71,263 respectively in the previous year. The percentage of success claimed being 95·82 in the year under review, against 92·86 in 1898–99. Of re-vaccinations there were 6,092 against 11,868, and the percentage of success was 92·42 and 95·70 in 1899–1900 and 1898–99 respectively.

In addition to the above there were 24,788 operations performed at dispensaries during the year, an increase of 10,712 compared with 1898–99 : of these ,18,166 were primary cases in British territory, and 1,987 in the States, with a percentage of success of 92·87 and 91·79 in the separate areas respectively, against 94·03 and 91·51 the year previous. Re-vaccinations numbered 4,578 against 1,411 in 1898–99 in British territory, and 57 against 64 in Native States, the percentage of success returned being 75·01 in British territory and 75·43 in the States, against 61·45 and 87·50 respectively the year before.

Calculated on an estimated birth-rate of 40 per 1,000, 60·18 per cent. of the infants born in the year were protected, against 44·61 in 1898–99, and 44·3 the mean of the previous three years.

The visitation of famine affected the important work of inspection, which was more or less confined to relief camps, and, as a consequence, the returns show a decline in this respect as compared with the preceding year ; it is stated, however, that "on the whole, inspection work was performed in a satisfactory manner." Civil Surgeons verified 15·99 per cent. of the total number vaccinated, and native superintendents 50·95 per cent., against 17·19 and 53·35 respectively in 1898–99. The percentage of successful cases approved was however higher, viz., 92·27 in the cases examined by Civil Surgeons, and 95·02 by Native Superintendents, as compared with 89·08 and 92·19 respectively in the previous year ; the vaccinators themselves claimed 96·65 per cent. as successful.

As in the preceding year the operations were done with humanised lymph, fresh calf lymph, and calf lymph mixed with lanoline and with glycerine. The degrees of success secured by the various kinds of lymph have again not been stated comparatively, but it is satisfactory to note that the use of glycerinated lymph, which in the previous year's report had been declared unsatisfactory, was given a further trial at the suggestion of the Government of India, with far more satisfactory results, a percentage of success of 86·27 being attained against 72·69 in 1898-99.

Berar.—The staff of the Department was precisely the same as that of the preceding year, viz., seven native superintendents and 44 vaccinators, and it worked up to its full complement under the control of the Sanitary Commissioner.

The total number of operations performed was 175,901, an increase of no less than 42,998 over the figure of the previous year; primary cases numbered 120,772 and re-vaccinations 55,129, against 94,032 and 38,871 respectively in 1898-99. The causes of this satisfactory increase are attributed to the high birth-rate, to the influx of unvaccinated persons due to the famine, the accessibility of children on relief works, and the use of lanolinated lymph.

The average number of operations performed by each vaccinator which stood at the high figure of 3,020 in 1898-99 rose to 3,997, and this excellent work was suitably acknowledged by rewards to six of the vaccinators.

The total number of successful primary operations numbered 115,789, and of re-vaccinations 9,522, compared with 91,286 and 8,989 respectively in the preceding year, which represents a percentage of 95·8 and 17·2 against 97·1 and 23·1 in 1898-99.

Assuming a birth-rate of 40 per 1,000 of the census population, 83·0 per cent. of those born are calculated to have been protected, a result largely in excess of that achieved in 1898-99 and during the quinquennial mean, for which the figures were 60·31 and 62·8 per cent. respectively.

The Sanitary Commissioner inspected 1·0 per cent. of the total primary operations against 2·06 in the previous year, and native superintendents 50·3 against 55·6 per cent.; the percentages approved by these officers as successful were 98·2 and 94·2 per cent., while the vaccinators claimed 95·8 per cent. of success.

Work was commenced in the middle of September with a supply of lanolinated lymph, obtained as usual from Mysore, the supply being maintained by calf-to-calf or arm-to-calf inoculation. Owing, however, to the famine, difficulty was experienced in procuring suitable calves for the latter procedure, and the only alternative was to resort to lanolinated lymph. To obtain all the paste required from Mysore would have been very costly, and the Sanitary Commissioner therefore arranged for its manufacture, in November, at Amraoti. The result of this arrangement was to produce the necessary supplies at a very considerably lower cost, and to admit of a larger number of operations at any one time or place, as the necessity for carrying calves from place to place was obviated. But the degree of success resulting from this paste was lower than that secured by the direct use of pure calf lymph, and has induced the Resident at Hyderabad to express the hope "that calf lymph will be reverted to as soon as circumstances permit."

Madras.—The Vaccination Department in this Presidency was as usual under the general control of the Sanitary Commissioner, assisted by the deputy Sanitary Commissioner, and the district medical and sanitary officers. The actual operating staff consisted of 61 deputy inspectors inclusive of those paid by municipalities, and 824 vaccinators; of the latter class there were six more than in the previous year.

This staff was responsible for a total of 1,147,820 operations as compared with 1,105,084 in 1898-99, and 1,258,010 in 1897-98, each vaccinator being credited with an average of 1,375 operations against 1,330 the year before. Although there is some decline on the total work of the year 1897-98, the results may be considered satisfactory, in that there is an increase in primary vaccination in local fund areas, and this is taken to indicate the subsidence of the plague inoculation scare which prejudicially affected the operations last year, and which doubtless has not entirely disappeared; there was, however, a decline in re-vaccinations.

Of the full total noted above, 1,086,602 were primary cases and 61,218 re-vaccinations, as compared with 1,028,221 and 76,863 respectively for the year before; and the percentage of success was higher, rising from 89·6 and 75·5 to 91·8 and 76·2, in the year under report. In addition to the above, the number of operations performed at dispensaries in 1899–1900 was 11,589 against 12,909, or 1,320 less than the year before.

Of this number 10,219 were primary cases and 1,370 re-vaccinations, and the percentage of success in the former rose from 83·6 in 1898–99 to 91·0, and in re-vaccinations from 68·1 to 71·5. With respect to the decline in Dispensary Vaccination, the Inspector of Vaccination and Deputy Sanitary Commissioner remarks:—"The number of cases in civil dispensaries shows a tendency to steadily decrease every year, and this is probably partly due to the increased energy exhibited by Local Fund and Municipal vaccinators."

Estimating the birth-rate at 40 per 1,000 of the census population, 22·74 per cent. of the infants were protected, as compared with 19·84 in 1898–99, and 22·81, the mean of the three years preceding.

The work of inspection received less attention than in the preceding year, the percentage verified to total operations falling from 3·0 and 56·7 by Civil Surgeons and Native Superintendents respectively to 2·8 and 51·6 per cent. during the year under report. The degree of success approved by Civil Surgeons fell to 82·1 per cent. from 86·0 per cent. the year before, but the results reported by Native Superintendents were better, viz., 88·1 per cent. successful as compared with 87·7 in 1898–99; vaccinators claimed 91·2 per cent. The Deputy Sanitary Commissioner apparently did no verification work. There was no new departure in the lymph used, which was of four kinds, viz., fresh calf lymph, animal lymph preserved in tubes or plates, glycerine paste, and lanoline paste.

The following exhibits the extent to which the several kinds of vaccine were used in the districts, excluding municipalities and dispensaries, as also the measure of success attending each.

—	Number of cases, primary operations and re-vaccinations.	Percentage of success.
Fresh Calf lymph	198,554	97·6
Ditto Preserved (without admixture) ...	102,902	95·8
Glycerine Paste	382,034	88·7
Lanoline „	348,213	88·5

In accordance with the experience of the past, the best results were secured with fresh calf lymph, and for the rest, as indicated in the order noted above. The results attained with lanolinated lymph in the previous year were slightly improved upon, and glycerine paste was far more successful than in 1898–99, when the ratio of success was only 82·4 per cent. It is notable that this last named preparation is now used as soon as possible after manufacture, the glycerine serving more as a diluent than as a preservative. The degree of success of glycerine paste would seem therefore to depend largely, in certain parts of India, on the time elapsing between the preparation of the paste and its use; the longer it is kept the greater the deterioration, so far as the experience of Madras tends to show.

Coorg.—During the year under review the constitution of the Vaccination Department was the same as in the preceding year, the staff consisting of one Native Inspector and eight Vaccinators under the supervision of the Civil Surgeon of the province. This staff performed a total of 9,996 operations, of which 8,091 were primary cases and 1,905 re-vaccinations, a satisfactory increase compared with the work of the previous year, when the total operations numbered only 5,283, and is attributed to the people having regained their confidence in the prophylactic which had been seriously shaken by the currency of a rumour that anti-plague inoculation was being practised in the guise of vaccination.

Of the primary operations performed 7,681 were successful, yielding a ratio of 94·93 per cent. against one of 93·15 per cent. the year before. Of the re-vaccinations 1,457 cases were successful, a percentage of 76·48 as compared with 80·93 in 1898-99. At dispensaries 481 operations were performed, as against 390 in the previous year; of these, primary cases numbered 309 and re-vaccinations 172, which proved successful at the rate of 75·40 and 55·23 per cent. respectively, against 72·80 and 60·93 in 1898–99.

The improved results of the year's work increased the number of infants protected from 7·38 to 11·70 per cent. of the births, estimated at 40 per 1,000 of the census population.

The inspection work of the Native Inspector shows an improvement, the percentage of his inspections to the operations performed having been 32·27 against 10·95 in 1898–99 and 31·93 in 1897–98. The Civil Surgeon's inspections fell from 7·95 to 2·25 per cent. The percentage of success found by these officers was higher than that claimed by vaccinators, viz., 90·35 per cent. Calf lymph was again exclusively used.

Bombay.—Excluding the Native States of the Presidency, the Department under the control of the Sanitary Commissioner, consisted of five Deputy Sanitary Commissioners and 45 Inspectors of Sanitation and Vaccination; while the operating staff comprised an average of 357 vaccinators.

The total number of operations performed was 769,267, of which 680,063 were primary cases and 89,204 re-vaccinations, which were successful at the rate of 92·60 and 41·62 per cent. respectively. This shows an increase of 98,823 on the total number performed in the preceding year, when the degree of success was 92·75 and 57·25 per cent. for the two classes of operations.

At dispensaries during the year, including those in Native States, 1,404 primary operations were performed and 2,257 re-vaccinations. This again is an improvement on the results of the preceding year, when the two classes numbered 998 and 917 respectively. The ratios of success were 88·95 and 88·83, as compared with 96·75 and 71·86 per cent. the year before.

The vaccination work carried out in the Native States consisted of 185,162 primary cases and 7,115 re-vaccinations, but these figures do not include the returns for the Palanpur State, for which the information was not received, as was the case in the previous year, and the returns are therefore comparable, and show a decrease of 7,733 primary cases and of 1,880 re-vaccinations as compared with 1898–99. The degree of success in the year under review was 95·76 and 70·04 for primary and re-vaccinations respectively, while in 1898–99 the results were 95·55 and 68·99 respectively. The majority of the operations were performed on infants and children under six years of age. The proportional protection afforded to the population of all ages was 27·01 per 1,000 against 28·23 in the previous year. The protection afforded to infants, calculating the birth-rate at 40 per 1,000 of the population, was 56·30 per cent., while in 1898–99 it was only 49·91 per cent., the mean for the three preceding years being 57·54.

The inspection work done by Deputy Sanitary Commissioners shows an improvement on that of the preceding year, having risen from 2·32 to 4·61 per cent. of the total number of operations, while the work of the Inspectors and Superintendents declined from 40·68 to 34·28 per cent. The percentage of success found by these two classes of officers was 90·65 and 96·92 respectively, against 85·83 claimed by the vaccinators themselves.

As in the previous year, inoculation was only practised in one place, which was, however, not the same, the offender, for the prosecution of whom steps were taken, plied his trade this year in the Kashmore Taluka of the Sind District. In addition to arm-to-arm vaccinations, it would appear that animal lymph was very largely used throughout the year, and in one place lanoline vaccine paste, obtained from the Bangalore animal vaccination depôt, was introduced.

Burma.—The Vaccination Department in Burma, under the control of the Sanitary Commissioner, was composed of the District Civil Surgeons, the Municipal Health Officers of Rangoon and Mandalay, 14 Native Inspectors (an increase of 2) and an average of 188 vaccinators (an increase of 11).

The total number of operations performed by this staff was 490,887 as compared with 466,308 in the preceding year and 421,786 in 1897–98. Both classes of work show an increase; primary cases rising from 439,050 to 456,762, and re-vaccinations from 27,258 to 34,125.

Re-vaccination has of recent years shown a steady rise, and it has been thought advisable to direct that more attention should be paid to the primary operation, as in the opinion of the Sanitary Commissioner, if this is efficiently performed, the need for re-vaccination is less urgent; nevertheless the work in the latter class is not comparable with the amount done in the small province of Berar.

The decree of success secured in primary cases was the same as in the year before, viz., 94·71 per cent., and in re-vaccinations 58·72 against 59·55 per cent.

During the year under review the Burma Vaccination Law Amendment Act was passed (Burma Act II of 1900), whereby the Superintendents of Vaccination in the Rangoon Municipality to which the Act may be subsequently extended, are empowered to require

unprotected persons to be vaccinated, and which provides for the compulsory vaccination of inmates of lodging-houses or coolie barracks. These powers should avail for the protection of the coolie immigrants in Rangoon, a class very liable to harbour and spread small-pox, the compulsory vaccination of whom was discontinued in August, 1896. It would appear that the Act did not come into force during the year under review, as the returns for the Rangoon Municipality are the lowest for the past 5 years, there having been only 2,457 primary operations against 16,083 in 1895–96, with 2,899 re-vaccinations against 7,568 in 1895–6. The discontinuance of the compulsory vaccination of adults is urged as the cause of the steady fall referred to, which, however, should now give place to a return to a better state of things under the new Act.

The rise in Dispensary Vaccination referred to last year was not maintained, there having been a total of 12,627 operations as compared with 14,349 in 1898–99. The decrease was, however, wholly represented by primary cases, these numbering 6,033 against 8,209 the previous year, while re-vaccinations showed an increase, 6,594, against 6,140. The percentage of success in these operations was 89·86 and 61·03, respectively, as compared with 88·66 and 62·70 in 1898–99.

As pointed out by the Local Government, the success in primary cases was considerably below the average for the whole province, while as regards re-vaccinations it was abnormally high. Many of the figures furnished are obviously incredible and impair confidence in the results as a whole, for, as it is noted, "in Magwe, 384 persons are reported to have been re-vaccinated, and all successfully, while in Sandoway, only four cases were successful out of 147."

Colonel Little remarks that "it is very evident that there is a considerable amount of false work returned by vaccinators . . . and an appreciable amount of incompetent and second rate work; this is clearly due to defective supervision and inspection, owing to the difficulty experienced by District Medical Officers in leaving head-quarters, and to the majority of the districts being without Native Superintendents."

The average number of operations performed by each vaccinator declined from 2,635 in 1898–99 to 2,611 in the year under review.

As in the preceding year, only primary vaccination was carried out in the Shan States; the figures, exclusive of the Dispensary Vaccination, were for the Northern States, 3,915 against 2,975, and for the Southern States, 4,347 against 3,750 in 1898–99. The degree of success, however, declined considerably, the percentage for the two States having been only 62·30 and 74·90, respectively, as compared with 82·49 and 86·80 per cent. in the preceding year.

Infant protection, taking the births at 40 per 1,000, is calculated to have been attained in 40·14 per cent. of the population under one year of age, as compared with 37·71 per cent. in 1898–99, and a mean of 29·4 for the three years preceding.

The inspection work of the Civil Surgeons shows an improvement, the percentage of cases verified to total operations having been 22·91 against 21·67 the year previous; on the other hand the work of the Native Superintendents shows a fall from 18·14 per cent. to 14·13 per cent. The staff of 14 Native Superintendents is considered inadequate, and the question of increasing the number is to be considered, but at the same time there appears to be no justification for the smaller display of energy than in previous years, especially in view of the quality of the work they have to supervise. Proposals for the reorganization of the entire establishment in order to secure better supervision, more general extension of vaccination, and a better quality of work, will be submitted to Government during the current year. The percentage of success found by the Civil Surgeons was 87·49, against 89·88 by the Superintendents, while vaccinators claimed 92·21 per cent. of their cases as successful. The corresponding ratios of success for the preceding year, were Civil Surgeons 89·35, and Native Superintendents 89·07 per cent., against the claim of 92·66 per cent. preferred by the vaccinators.

It is reported that the practice of inoculation prevails pretty generally throughout the province, and it is not surprising to find that the persons responsible and to whom it means a livelihood discredit vaccination, "as they spread small-pox from village to village." They have the sympathy of the people who are accustomed to the practice, and therefore, while appreciating vaccination, "prefer the old, though mischievous, usage, to what they regard as foreign inventions." Some of the native Burman officials exercise their influence to discredit vaccination.

The operations of the department were carried on by the use of humanized lymph through arm-to-arm transfer, and by glycerinated lymph prepared at the Rangoon and Taunggyi depôts. Some lanoline lymph was obtained from Bangalore and used in certain Municipal towns; no details are available as to the comparative results obtained.

It appears, however, that the lymph prepared at the Rangoon depôt was fairly successful, and met all reasonable requirements ; the quantity of vaccine prepared, as the result of the inoculation of 126 calves, was 27,390 grains, of which 26,971 grains were issued for use, as compared with 16,979 grains issued during the previous year.

The outturn of vaccine from the Taunggyi depôt was greatly in excess of that during either of the two preceding years, but the number of grains actually issued is not stated. In the early part of the year lanoline paste was prepared, but this preparation showed a tendency to become mouldy and to decompose readily, and so this vehicle was replaced by the use of glycerine, but even this was found to retain its potency only for a comparatively limited time. The results of the vaccine issued are conflicting, very good results being obtained in some places, while elsewhere it proved almost a complete failure. Various causes are assigned for this, but the Sanitary Commissioner considers a most important, if not the main, factor, to be probably the free use of perchloride of mercury both in the preparation of the calf and the collection of the vesicles. Difficulties in obtaining calves, &c., have decided the Sanitary Commissioner to propose the removal of the depôt to Meiktila, making it the source of supply for Upper Burma, while the Rangoon depôt will be available for Lower Burma.

Ajmer-Merwara.—In this small area of British territory in Rajputana, vaccination was as usual supervised by the Civil Surgeon of Ajmer. The staff comprised one Native Supervising officer and 13 vaccinators, being the same as in the two preceding years.

In 1899–1900 a total of 27,080 operations were performed, or an increase of 9,132 over the number for 1898–1899. Of the 26,077 primary operations, 25,838 were successful, a ratio of 99·08 per cent., and of the 1,003 re-vaccinations 911 were successful or 90·83 per cent. The percentage of success in the year 1898–1899 was 98·46 and 65·15 for the two classes respectively.

Calculated on an estimated birth-rate of 40 per 1,000 of population, the proportion of infants protected was 63·11 per cent. of the whole, compared with 55·34 per cent. in 1898–99, and a mean of 49·4 during the three years preceding.

Inspections by the Civil Surgeon were confined to the Ajmer district, where he examined 8·48 per cent. of all the operations performed therein, and found 98·91 per cent. successful ; the Native Superintendent verified 39·19 per cent. of the work, of which 98·70 per cent. was found successful.

Civil Sanitary Works.

Bengal.—There was no alteration in the number of municipal towns in Bengal during the year 1898-99 ; there are 151 excluding Calcutta, and their income during the year, including the opening balance of £26,731, amounted to £283,154, or £1,178 less than that of the previous year. Of the total income, 44·75 per cent. was spent on sanitary works (original and recurring), 9·97 per cent. on roads, 4·48 per cent. on measures for the preservation of public safety, and 29·32 per cent. on all other requirements ; these figures closely approximate to those of the previous year. The expenditure on water-supply was £13,426 against £17,511 in 1897-98, a decrease of £4,085, explained by a reduction in the capital and maintenance outlays on account of the Howrah and Bhagalpur works. Under conservancy there was a slight increase of expenditure amounting to £182, the total sum thus allotted being £70,768 during the year under review. Drainage works involved an expenditure of £7,785 against £7,564 in the previous year, but the cost of markets and slaughter houses showed a falling-off from £2,922 to £2,066 due to the decreased outlay by the Narayanganj and Darjeeling municipalities under this head.

The average proportion of municipal income applied to original sanitary works following the tendency of the last few years, was only 2·67 per cent. ; in the previous year it was 3·57 per cent., in 1896-97 it was 3·70, and in 1895-96, 5·03 per cent. Only 10 municipalities devoted over 10 per cent. of their income to this purpose, against 15 in the previous year, while 53, against 41 in 1897-98, spent nothing on this account. The tendency in recent years has been steadily backward and the Sanitary Commissioner expresses regret that such important *Sadr* towns as Faridpur, Comilla, Chittagong,

Chapra, Motihari, Muzaffarpur, Monghyr, Cuttack and Hazaribagh failed to carry out any original work whatever, and certainly a glance at Annual Form No. XI of the Provincial Sanitary Report is convincing in respect of the necessity of a more vigorous policy.

On the other hand the average expenditure under annually-recurring works, which was 41·73 in 1897-98, rose to 42·08 per cent., the proportions ranging from 65·98 per cent. in Berhampore to 8·93 per cent. in Chandpur.

The expenditure of public funds on rural sanitation amounted to £16,298 against £21,565 in the previous year, and £26,685 in 1896-97. Private individuals provided £20,328, which is a sum less by £12,060 than that of the previous year. That the total expenditure allotted to sanitary works in rural areas fell off by some 2½ lakhs in the year under review, if not satisfactory, was to be expected, owing to the diminished stimulus to the benevolent and wealthy which a generally prosperous year provides.

The official constitution of the Sanitary Board remained unchanged, though there were a few alterations in the *personnel* owing to official transfers and leave vacancies. Three meetings were held during the year, but consultative work was also carried on as heretofore by the circulation of papers to the members. The principal matters taken into consideration at the meetings were :—

(1) Model bye-laws for privies and urinals.
(2) The functions and powers of the Sanitary Board.

The more important preliminary estimates prepared under the orders of the Board were :—

(1) The scheme for the improvement of the Darjeeling water-supply. The Sanitary Engineer, after an enquiry into the present system, formulated a scheme estimated to cost £12,250, which has been adopted by the municipality.
(2) Patna water-works. The experiment, alluded to in last year's report, for obtaining a supply from a well sunk in the old bed of the river Sone having been successfully concluded, preliminary estimates for a series of wells to be sunk near the experimental well were drawn up and nearly completed at the close of the year.

Detailed estimates in connexion with the following works were prepared, viz :— Two alternative schemes for filter beds for the purification of the water-supply of Patuakhali ; one was approved and sanctioned by Government.

The plans and estimates which were noted in last year's report for the flushing of drains in Ward No. 5 of the Patna Municipality and for the Berhampore water-works having been approved, the works were completed during the past year and are reported to be most successful.

Estimates and plans for the following projects were considered :—

(1) Improvement of the drainage of Manicktolla. This scheme, which had to be returned for re-submission, was partially approved, certain modifications being proposed.
(2) Drainage of the Siwan Municipality. This project having been revised according to the suggestions of the Sanitary Engineer was approved by the Board, and recommended to the Government for sanction.
(3) Re-modelling of the intake of the Dacca water-works. Owing to the silting up of the channels from which the water is taken, it was proposed to ascertain whether a sufficient supply could be obtained from wells sunk in the *chur*. The Executive Engineer was authorised to conduct the necessary boring experiments.
(4) Dinajpur drainage scheme.
(5) Drainage project for Chattra and the western portion of Serampore. Instructions were issued to the local authorities to revise the scheme.
(6) The intake of the Bhagalpur water-works. Owing to the choking of the intake with sand, a proposal has been made by the Board that the most satisfactory solution of the difficulty lies in the sinking of a system of wells, and the Chairman of the Municipality has been so advised.
(7) Drainage scheme for the Challam bheel in Rajshahi.

During the year drainage surveys of Khulna and a part of Serampore were completed, and that of the Rishra bustee in Serampore was in progress. Miscellaneous references were made to the Board by Government and by local authorities, notably in connexion with the drainage projects of the Natore and Bihar Municipalities.

The sewage disposal experiments referred to in last year's report were carried on, but no definite report of the results has been presented, owing to the Sanitary Engineer's desire to submit the system for a whole year "to the several tests in the matter of the concentration of the sewage dealt with." It is understood, however, that the experiments have so far been successful.

The Sanitary Engineer made numerous inspections of towns in connexion with various sanitary works and schemes, and the Board tenders its acknowledgments of his "active and efficient service."

Assam.—The total income of municipalities and all local bodies during the year was £18,395, as compared with £17,326 in the previous year; and of the total 42·74 per cent. was spent on sanitary works proper, as compared with 45·52 per cent. in 1898.

Shillong station comes first with an expenditure of 79·37 per cent. of income, followed by percentages in Gauhati of 77·98, and in Dibrugarh of 72·23, down to the Barpeta municipality with 38·23. No work of capital importance was undertaken, but the money is said to have been well spent on the various objects of vaccination, drainage, market places, improvements to water-supply and general conservancy. The Gauhati municipality spent a considerable sum in the repair of existing drains, and £976 went to the improvement of the water-works and the purchase of a new pontoon and pulsometer. In Shillong station the old latrines have been cleared away and replaced by new pattern iron structures, and while something has been done to repair the damage done to the water-works by the earthquake of 1897, it would appear that funds are needed to complete the works. The water-supply of Sylhet has been improved and largely increased by the sinking of a new well.

In rural areas the chief sanitary measures undertaken have had reference to the water-supplies, the excavating and cleaning of tanks and the sinking and repairing of wells.

The use of the village sanitary inspection books has not improved during the year; some districts have neglected the orders on the subject altogether, and in the majority, where the letter of the rules is carried out to a greater or lesser extent, the practical benefit has so far been insignificant or altogether wanting.

The Sanitary Board held no formal meetings during the year, but the opinions of the members were obtained on all sanitary matters of importance by the circulation of papers. The Government of India having invited attention to this matter in their review of the report for 1898, meetings of the Board "have since taken place and will be continued in future."

North-Western Provinces and Oudh.—The number of municipal towns remained the same, 104, as in the previous year. Excluding opening balances, the total municipal income was £318,355, compared with £298,878 in the previous year, and the total expenditure on sanitary works amounted to £110,590, or 35 per cent. of the former sum. The expenditure on water-supply was £36,196, a slight increase on that of 1897-98; on drainage it was £7,754 against £12,073 in the previous year, and on conservancy it was £64,751 against £66,009; the sum allotted to markets and slaughter houses was £1,889, practically the same as the previous year.

The more important sanitary works undertaken during the year included no new departure, but took the form of the development of schemes already commenced; these were, notably, considerable extensions of the new sewerage works at Benares and extensions of the Naini Tal and Cawnpore water-works. Although only nine of the municipal towns have been furnished with a pipe water-supply, it is pointed out that nearly one-third of the entire municipal population of the province now enjoys this advantage. There is abundant evidence that every care was devoted to all the details of management, and to the improvement, where necessary, of the various works.

At Agra, the average daily consumption per head fell slightly, from 8·96 gallons to 8·61; in the cantonment also a decrease of consumption was registered, viz., from a daily average of 164,013 gallons in 1897-98 to 156,679 gallons in the year under report. The cost per thousand gallons of filtered water, which was 1·59 annas in the previous year, rose to 1·65 annas, but a large expenditure was incurred in special repairs to engines and pumps.

At Allahabad, owing to the early cessation of the rains; the average daily consumption of filtered water rose from 1,410,229 to 1,490,803 gallons, equal to 8·5 gallons per head of the population, and this was distributed at a cost of 1·61 annas per 1,000 gallons, a trifling increase over that of the previous year. Observations having shown that a loss of 90,000 gallons a day was taking place from one of the filter beds, closer investigation proved that the floor was badly cracked and this was successfully repaired.

At Benares the consumption of filtered water has shown an extraordinary increase, as the following figures demonstrate :—

	Gallons.
1897-98	695,404,100
1898-99	852,670,719
1899-1900	960,202,743

Thus, within three years, the consumption has risen nearly 40 per cent., although the house connexions have only increased 12 per cent. The quantity per head represented by the figure for the past year is 12·2 gallons, largely in excess of that of any other municipality in the province ; there is evidence of large wastage due to defective pipes, taps and fittings, and to misuse of the water for house-drain flushing. The cost per 1,000 gallons was only 1·01 annas.

In Cawnpore the daily average consumption of filtered water was 9·17 gallons as compared with 8·74 in the previous year, the cost per thousand gallons being 2·05 annas. A steady increase in revenue from the sale of water is noteworthy, but the city is exceptionally situated in this respect.

At Lucknow the average daily consumption in the city and cantonment was 1,071,498 gallons, equal to 5·4 gallons per head of the population within reach of the supply ; the cost per thousand gallons was 2·06 annas. In addition to this filtered water, 64½ million gallons of unfiltered water were supplied to the Parks during the year.

In Meerut there has been a gradual decrease in the consumption during the last three years, *viz.*, from a daily average of 461,899 gallons in 1897-98, and 406,235 in 1898-99 to 336,008 in the past year ; this decrease is the subject of enquiry.

At Naini Tul the daily supply of water was over 11 gallons per head of population. I have already noted that the remodelling and extension of the system was completed during the year, and pure drinking water is now delivered within a short distance of every house in the settlement, besides being extended to the cantonment. The total expenditure on the works to the end of the year amounted to £14,615 against a sanctioned estimate of £17,000 ; and there will ultimately be a saving of over £1,600.

During the year samples of the various filtered supplies were regularly analysed, chemically and bacteriologically, "and were almost invariably found free from suspicion." In September it is said that "enteric microbes were detected in the Agra Cantonment water, but the mischief was checked before any evil effects resulted."

The new sewerage works at Benares made fair progress, and an expenditure of £4,850 was incurred thereon during the year.

The question of the disposal of the Cawnpore sewage was fully considered. Various proposals have been put forward, including schemes by English Sanitary Engineers, and the whole subject has lately been carefully considered by the local sanitary and engineering authorities whose joint note is now under discussion by the Municipal Board.

Surveys and estimates in connection with the following towns were carried out and prepared : Aligarh, Hathras, Saharanpur, Pilibhit and Sitapur.

The Sanitary Board held four meeting during the recess : three at Naini Tal and one at Agra, and the following were among the more important matters that engaged their attention :—

(1) The report by the Sanitary Engineer on the quality of the municipal water-supplies. It was noted that the "quality of the water was quite satisfactory," except in the case of Agra where it was deemed necessary to take further precautions to prevent contamination of the river near and above the intake and to provide additional filter area. Designs and estimates to this end were prepared and approved.

(2) Certain objections raised by the military authorities to the condition of the river banks above the intake of the Benares water-supply were considered, and the fact that the very numerous chemical and bacteriological tests carried out during the last two years showed an exceptional standard of purity, was held to be strong evidence that danger was more hypothetical than real. It was, however, recognised that additional safeguards should be employed to purify sullage water discharging into the river.

(3) The water supply of Jhansi. It was decided that alternative schemes for obtaining a supply from wells and from the Pahuj river should be fully considered.

(4) Various questions raised by the Sanitary Commissioner regarding details in connection with the Benares sewage works were referred to the Board for consideration, and recommendations made thereon.

(5) A note by the Sanitary Engineer on the question of a drainage scheme for the town of Deoband was discussed, and the Board recommended that the Irrigation Department should prepare a complete scheme for the drainage of the area surrounding the town, as a preliminary measure, as otherwise no efficient outfall for the town drainage is practicable.

Punjab.—The total income of the 31 municipal towns, including the opening balance, was £385,271, as compared with £368,806 in 1898; there was a corresponding increase of expenditure on sanitation which amounted in the aggregate to £93,446 against £75,007 in the previous year. The increase is fairly distributed over all the more important heads of sanitary work; drainage and sewerage, however, coming first with nearly one lakh in advance of the outlay in 1898, while the cost under conservancy establishment shows an excess of about half a lakh, and water-supply one quarter of a lakh. The sum realized from the sale of manure in all municipal towns amounted to £9,521, as compared with £9,900 in 1898 and £9,942 in 1897; the question of this decrease is the subject of enquiry.

The principal sanitary works completed, in progress, or under consideration during the year, were the following:—

The excavation of the settling tanks and filter beds of the Delhi water-works was completed and the masonry work commenced. The huge Seog reservoir (near Simla) and the whole of the work on the weirs, screening tanks, filter-beds and pipe laying of the gravitation supply to the pumping station at Cherát, in connection with the Simla water-works extension, was completed. Beyond this, additions and alterations to some of the filter-beds were carried out, along with some minor works in connection with the distribution system. Survey work for the new project for the extension of the sewage system is in active progress. Various schemes for the drainage of certain cities and towns are in different stages of initiation or progress, but the only work of this kind actually completed was in Ladwa; the important Chandni Chauk section of the Delhi drainage works was held in abeyance for want of funds, and the Umballa city drainage scheme awaits sanction. Various sanitary works of public utility were constructed by private individuals at their own expense during 1898–99—wells, tanks, rest-houses. The aggregate amount expended in this way by private charity being £5,162.

There is evidence that the important question of rural sanitation is engaging the earnest attention of the authorities. The village sanitary note-books are having a fair trial in most of the districts, and the endeavour to stimulate the interest of the people themselves in the cause of sanitation by the offer of monetary rewards to the village in each tahsil which shows most improvement in its sanitary condition, is still in the experimental stage.

There were seven meetings of the Sanitary Board during the year. The question of extending the scope of the Board's powers and functions is still under consideration, and certainly in the record of the proceedings for the year there is evidence that its energies and abilities are not suitably employed, and in this respect the contrast with the work and usefulness of the Boards in the North-Western Provinces and Bengal is marked.

Central Provinces.—The income of the 18 *Sadar* towns which was £95,467 in 1897–98 fell to £67,263 in 1898–99, a remarkable decrease which is not explained, but the total expenditure on sanitation rose from £20,882 to £27,159. The most notable increase under any one head is in the expenditure on water works; in the former year the sum so allotted was £5,275 against £13,092 in the latter. The cost of conservancy on the other hand fell off from £13,992 to £12,294.

The "Fraser" water-works at Wardha were completed and opened for use in November 1898, the total cost amounting to £15,027. The Bhandara water-works, begun in February 1898, were approaching completion at the end of 1899, and have since been opened.

The Harda scheme is still held in abeyance owing to a difficulty about funds, but a temporary project has been prepared to which a sum of £1,334 has been allotted by the Municipal Committee.

The drainage of the city of Jubbulpore has been started on a systematic plan, but it is noted that progress must be slow until the loans raised for the water-works have been paid off. A good deal of useful work was carried out in the way of laying down *pucka* drains in the lanes and alleys of the worst part of the town, and linking these up to the

street drains. Considerable progress has been made on the outfall drain, and facilities are being offered to owners of adjacent land to utilise the sewage thereon ; the result on the crops already raised is reported as favourable.

The provisions of the Village Sanitation Act have now been extended to 40 villages in all, but the Sanitary Commissioner notes of seven districts that the Act is either not in force, or was not enforced during the year. The total expenditure on village sanitation amounted to £4,099 out of a total allotment of £8,793. Of the sum spent, £1,923 went to the construction of wells, and £666 to repairs of wells ; £770 were devoted to the cleaning of village sites, and over £100 were expended on roads and drains. Wardha district stands first with a total expenditure of £1,050, followed by Bilaspur with £533, and Chanda with £400 ; six districts spent less than £67, and one district, Damoh, spent nothing at all on village sanitation.

The work of preparing sanitary maps, forming sanitary circles and drawing up village lists had been so far completed in 1898 that it was proposed to commence the registration of vital statistics on the basis of the new sanitary units, on January 1st, 1899. But in view of the presence and the danger of the spread of plague, together with the lack of funds, it was decided to postpone the new departure, and another year or two will probably elapse owing to the recurrence of famine, before it can be introduced with a fair chance of success. The presence of famine has also militated against progress generally, as much routine inspection work by civil surgeons had to be suspended in favour of more pressing duties.

The Sanitary Board for the same reason held only one meeting during the year. The principal business was the discussion of the proposals and estimates for works of sanitary improvement in villages.

Berar.—The estimated income of the 12 municipal towns in Berar in 1899 was £18,116, against £17,702 in 1898 ; the actual expenditure on sanitation was £8,776 as compared with £8,984 in the former year. The percentage for the province is therefore 48·5, and ranges from 72·6 by Shegaon to 29·2 by Akot. The aggregate expenditure on water supply was £2,416, against £2,898 in 1898 ; on conservancy £4,767, against £4,209 ; on drainage £158, against £196 ; and on miscellaneous works £1,437, against £1,682 in the previous year.

Karinja has invested £1,334 for its drainage scheme, which will be put in hand after a proper survey has been carried out by the Public Works Department. Plans are being drawn up for a drainage scheme for the Ellichpur Municipality.

The outlay on water supply represents the repayment of loans, the Public Works maintenance charges for tanks and pumping charges. The deficient rainfall of the past two years has made the water supply question a critical one owing to the drying up of tanks, and the Sanitary Commissioner urges the provision by municipal bodies of a two or three years' supply, to be obtained by the enlargement of the tanks by famine labour. Something was, however, done in each district outside municipal limits to increase and improve the scanty supplies by deepening tanks, sinking new wells, and in cleaning and repairing old wells. Out of a total expenditure of £4,196 on these measures the Akola and Amraoti District Boards spent over £2,700.

The total sum expended by District Boards on sanitary works outside municipal towns was £7,954, against £5,170 in the previous year ; included in the former sum there was an increase of £496 under drainage, and of £2,252 under water supply.

At most of the towns night soil is trenched, and the ground is cropped "wherever feasible." But in some places night soil is still buried in pits and subsequently sold to cultivators, and the Sanitary Commissioner hopes soon to be able to report that the latter method of disposal has given place to the former in every municipal town.

A large amount of work devolved upon the medical and sanitary executive in the supervision and sanitary control of famine relief works, and it was only to be expected that under the circumstances the cause of village sanitation should receive less attention than usual.

No information is given by the Sanitary Commissioner about the proceedings of the Sanitary Board, an omission that was noted last year, but to which attention has been drawn in the review of the report for 1899.

Madras.—Excluding the Presidency town, the estimated income of the 60 municipal towns in Madras for the year 1899-1900 was £233,208, as compared with £197,082 in the previous year. Although a sum amounting to £129,574 was allotted for sanitary purposes, the aggregate actual expenditure during the nine months ending December,

1899, was £60,906, against £56,330 in the corresponding period of the previous year. The relative distribution of these sums in the two years may be seen at a glance in the subjoined statement, which also gives the figures for the city of Madras for comparison.

Heads of Expenditure.	Sixty Towns. Population=1,687,563.		Madras City. Population=436,375.	
	1898.	1899.	1898.	1899.
	£	£	£	£
Conservancy	33,212	32,652	19,734	22,600
Improvement of village sites	10,136	11,633	3,530	4,618
Improvement of water-supply	8,021	13,082	887	2,818
Sanitation of fairs	499	504	7	—
Markets and slaughter houses	550	969	1,900	5,022
Other miscellaneous sanitary works	3,912	2,066	9,908	4,656
Total	56,330	60,906	35,966	39,714
Income	197,082	233,208	89,877	96,477

The Sanitary Commissioner points out that no public body could foresee whether its ordinary resources or its borrowing powers would not be strained to the utmost by being called upon for extraordinary expenditure on account of plague measures, and hence the policy pursued was to keep a considerable balance in hand; consequently no sanitary work of great importance was initiated during the year. The water-supply system of Tirupati was completed in time for the great annual Hindu festival held there, and the extensions to the water-supply systems in Tanjore and Conjeeveram were also completed. But beyond this, important works are in the stage of consideration or suspension. For example, schemes were under the consideration of the Sanitary Board for the improvement of the water-supply of Tuticorin, for the extension of the Trichinopoly water-works, and for water supplies to Guntur, Periyakulam and Bezwada, and these were laid before Government. Preliminary proposals were also considered for the water-supply of Vizianagram, Cuddalore, Ellore, Negapatam and Saidapet, for the improvement of the water-supplies of Ootacamund and Cuddapah and for the drainage of Kumbakonam, Madura and Cuddapah. The following projects received Government sanction, viz., for the extension and improvement of the water-supplies of Trichinopoly and Tuticorin, for the water-supply of Coonoor, and for the drainage of the Tanjore Fort. In the less ambitious but very important sphere of conservancy in municipalities, the evidence adduced goes to show that very considerable progress has been made during the past four years, and the efforts of the Sanitary Commissioner to "substitute quality for quantity" in the matter of the supervising staff, by the employment of certificated Sanitary Inspectors in the place of the uneducated overseer and maistry, have been amply justified by the results. The amount realised by the sale of night-soil and rubbish was £2,130, but the ryot who originally looked askance at inodorous poudrette is gradually losing his prejudices in face of the excellent results of the raw article on his crops, and the price of night-soil shows a steady advance. Trenching, followed by cropping, under municipal auspices, was conducted as an object lesson at Bellary, Erode, Anakapalle and Nagore. At Karur, Rajahmundry, Tinnevelly and Negapatam sewage farming was conducted with profit, and at Kumbakonam, Bezwada, Vizagapatam and Vizianagram "biological" purification (intermittent downward filtration) was employed to protect streams to which the sewage would naturally gravitate, from gross pollution. At Guntur and Vizagapatam arrangements are in progress for sewage farming to be started next year.

The estimated income of the District Boards in 1898-99 was £574,323, and the allotment for sanitary purposes was 7·2 per cent. against 8·3 in the previous year; this ratio implies an allotment per head of population of 3·6 pies. During the nine months, period ending December, 1899, £25,796 were spent (against £24,656 in the corresponding period of the previous year), and this included the sum of £17,260 on conservancy and £3,372 on water-supplies. The falling-off noticeable in outlay during the past two years

is attributed to the necessity for keeping funds in hand for the possible call for expenditure on plague measures, but also to the questionable "economy" of district boards in discharging "sweepers" who would not remove night-soil, but whose places should have been taken by scavengers proper. Although the fear of plague has been the beginning of wisdom as regards sanitary effort in some places, in others it is to be feared that the cause has suffered owing to the "economy" practised to maintain an available fund for the emergency. The Sanitary Commissioner criticises the system of the formation of the union for practical sanitary effort, his main objection being that the available funds are dissipated in small useless measures such as lighting in the richer neighbourhoods, whereas district boards should concentrate their resources on definite works of a permanently useful kind in selected villages where the need is most crying. Another useful feature of his report is the critical discussion of the results on the public health of the schemes of water-supply and drainage already carried out.

The constitution of the Sanitary Board remained unchanged, but the rules for the conduct of business were modified to permit a local board or municipal authority to apply to Government for orders when it objects for financial or other reasons to adopt a design or estimate prescribed by the Sanitary Board. The Board scrutinised plans and estimates for one provincial, 34 municipal, and 79 local fund works of the estimated aggregate cost of £128,875. Six new standard type designs of minor sanitary works were approved for issue, the Board keeping in view the necessity for the less expensive designs suitable to the moderate resources of the minor local bodies.

Coorg.—A sum amounting to £432 was expended in this small province during the year 1899, of which £319 were expended in the erection of the D'Souza European ward and nurses' quarters at the Mercara hospital, the balance being chiefly devoted to conservancy and to repairs of existing water-supplies.

The Sanitary Board held three meetings during the year, at which plague regulations were discussed and approved, and various other practical matters connected with the apprehended outbreak and spread of the disease were settled.

In order to enhance the value of the village sanitary inspection books the civil surgeon has drawn up a series of simple and practical questions to be answered by the village head-men, which will, it is hoped, serve to direct attention of this official to the chief points of his duty, and maintain a useful record of actual work accomplished.

Bombay.—The number of municipalities in the Presidency in 1899 was 166, excluding Bombay City; these contain an aggregate population of 2,200,455 souls, the total income for 1898-99 being £368,466, or £13,366 in excess of that of the previous year. Of this sum £182,924, or nearly 50 per cent., were allotted for sanitary works, and 85·16 per cent. of the allotment (£155,778) was spent. The chief items of expenditure were £67,000 on conservancy, £31,103 on water-supply, £9,398 on town sites improvements, £4,172 on markets and slaughter-houses, £2,438 on the sanitation of fairs, and £41,669 on miscellaneous minor sanitary projects, *e.g.*, construction and repair of tanks, &c. These sums are approximately equal to those spent on the various objects in the previous year, except in the case of water-supply, on which the expenditure incurred was about £3,400 less than in 1897-98.

The Sanitary Board prefaces its report once more with the statement that, owing to the heavy expenditure incurred in the campaign against plague, the financial pressure upon municipalities has caused the deferment of many important sanitary projects. During the past year famine has involved a further claim on municipal finances, and in default of Government aid the prospects of sanitary work in the near future are very unpromising.

At Hyderabad municipal "dissensions" have caused delay in the erection of the new engines and in the construction of the engine-house for the river pumping station. The plans and estimates for the final completion of the water-works are still under the consideration of Government.

At Ahmedabad the drainage-scheme prepared by Mr. Baldwin Latham is still under discussion, and little progress is anticipated until a special engineer is put in charge of the work, as the local Executive Engineer has his hands full of other pressing matters.

At Kaira and Mehmadabad and Yeola the situation has not advanced from the position indicated in last year's report.

At Ahmednagar the completion of the Kapurwadi tank is now being carried out as a famine relief work; the distribution scheme in connexion therewith will shortly be forwarded to Government, but unless a loan is forthcoming there is no near prospect of practical results.

At Poona the drainage-scheme has been approved by the municipality, by Government, and by Mr. Santo Crimp, who was called in to advise. The original project to treat the sewage on the septic tank system has been modified in detail, but not altered in principle. In place of septic tanks and filters, it is now proposed to pass the sewage first through shallow upward filtration beds (the so-called "macerating tanks" in use at Wimbledon) and then to dispose of the effluent therefrom upon arable land for farming. This excludes the alternative plan of turning the effluent into the river, and as experiments have demonstrated the value of the effluent as food for crops, a large saving on the expenditure is looked for from the return on the farming operations.

A water-supply scheme for the city is also under preparation, and it is hoped the project will be ready for discussion by June 1900, but here again much depends on Government assistance, if the practical results are to be realized at a comparatively early date. The Sanitary Board adds "regarding the other towns and projects no progress has been made, and each year only enforces the urgency of the representation made last year to Government, to the effect that the Board should be granted executive and not merely consultative powers; and this especially in times like the present when every Executive Engineer is over-worked owing to the operations of famine relief."

In addition to the above, the Board advised on several minor projects, *e.g.*, the water-supply to the Central Jail at Hyderabad, on the Ahmedabad Sewage Farm, etc.

The district boards as a whole appear to have recovered from the financial depression of the last two years; their aggregate estimated income rose from £256,146 in 1897-98 to £381,833, but of this sum £38,627 were allotted to sanitary works, or only some 10 per cent. as against 18 per cent. in the previous year. The actual expenditure was, however, only £22,814 against £32,164 in 1897-98, and of this sum 72·44 per cent. (£16,530) was actually spent on improvements to water-supplies.

The Village Sanitation Act was introduced into five more villages during the year, but abolished in four villages, an increase of one, making the number 330 in all, in which the provisions of the measure operate. The village sanitary inspection books are in use in 3,225 villages against 3,199 in the previous year; it is, however, again noted that the presence of cholera and famine have interfered with the full utilization of these records.

The number of meetings held by the Sanitary Board is not stated, but the members are, apparently, in continuous communication with each other, and much useful work was done during the year, to the most important of which allusion has been made above.

Burma.—The total income of the towns and districts in Upper and Lower Burma in 1899 was £565,544, or £113,778 more than that of the previous year; the aggregate expenditure under all heads for sanitary purposes was £151,070 or £3,043 less than in 1898. This amount includes a sum of £55,846 for "other sanitary works," some of which have a very indirect bearing on sanitation. The amount devoted to water-supply was £55,746 against £26,056 in 1898; on drainage £27,770 against £27,255, and on conservancy, £43,661 against £40,508. The percentage of income spent by municipalities on sanitary works was on the average 34, but varied irregularly through a wide range, the only consistent item being conservancy and "other sanitary works." Only 13 of the 40 municipalities spent anything on water-supply, and of these 13, Rangoon and Prome, spent only 8 and 7 per cent. respectively, the other 11 being credited with insignificant sums. Again, only about half the number of these towns spent anything on drainage, and neither in this respect nor in that of water-supply was any work of importance undertaken. In 27 towns the expenditure on conservancy was less than 20 per cent.; in Kyaukpyu and Mandalay, by an obvious error, nothing is shown under this head, and a perusal of the reports of the Health Officers affords striking evidence that much remains to be done in the way of simple sanitary reform.

The Rangoon water-supply which has long been a reproach to the responsible local authorities, is now receiving the attention it deserves; the present supply from the lakes has been definitely proved to be liable to gross pollution, and the solution of the problem appears to lie in the direction of the resort to tube wells and the filtration of the water from selected lakes, the drainage area of which will be more scrupulously conserved.

The scheme for the Moulmein water-supply has also exercised the responsible local authorities, and the report of a committee of Engineers appointed to report on Mr. Foy's plans has been received and considered by the municipality, and it has been decided that the work should be carried out as a contribution work by the Public Works Department.

The preliminary survey of the Kanthonzin water-supply scheme for Bassein was completed, and as the Sanitary Commissioner remarks that this town badly needs a good water-supply, it is to be hoped that the difficulty in the provision of the necessary funds (estimated at

about £27,000) which the Municipal Committee declare they are unable to meet without help from Government, will not compel a resort to the dangerous alternative of a resort to open surface tanks.

The Mandalay water-supply is obtained from deep and shallow wells, only a "few" of which are reported by the Health Officer as "pure and wholesome." It is said that a "few have been remedied during the year, and there is much more to do," but funds are wanting. Mandalay spent nothing on water-supply, and only 1 per cent. of its income on all sanitary works.

A scheme for the improvement of the open surface drainage of Rangoon is under consideration, which should include the prevention of the abuse of these channels by a stringent reform of the conservancy arrangements and the prosecution of offenders. The attempt to obtain a survey of Moulmein for the improvement of the drainage has been frustrated by the departure of the surveyor and the incompetence of his successor. A scheme for the improvement of the Prome drainage has received the approval of the Sanitary Engineer, and is now in hand; this involves the construction of a total length of 20 miles of channels, of which two have been completed. The general scheme for the drainage of Bassein awaits a solution of the water-supply question already alluded to.

Village sanitation is receiving more attention, but progress, as is to be expected in Burma, is slow; it is something to have a definite assurance that the necessity of conserving the water-supplies is being more widely recognized by the people, but it is noted that the district medical officers have not in all instances given so much attention to this part of their duties as could be wished.

No meetings of the Sanitary Board were held during the year owing chiefly to official changes and departures. Proposals for the resuscitation of the Board and for some alterations in the procedure for the disposal of work are under consideration, and will shortly be submitted to Government.

General Remarks.

The investigation of Indian fevers.—The brilliant researches of Major Ronald Ross which were summarised in this report for 1897, and the confirmation they have received at the hands of Koch and the Italian school, and not least of the new English schools, have had a marked influence in inciting recent workers in India to the pursuit of observations in the new field of parasitology thus opened up.

As one important result we may cite the work of Captain S. P. James, I.M.S., independently confirming the observations of Manson, Bancroft and Low, that mosquitoes of the genus Anopheles are capable of acting as efficient intermediary hosts of the parasite of "Filariasis" (*Filaria Sanguinis Hominis*); and as regards the practical point of the mode of infection, his dissections of the head tissues of the *Anopheles Rossii*, after the *filaria* had undergone its metamorphosis during a period of 12 to 14 days, leave little doubt that (in the words of Bancroft) "young filariæ may gain entrance to the human host whilst mosquistoes bearing them are in the act of biting." On the question of the rôle of the mosquisto in the propagation of malarial fevers a considerable and increasing number of medical officers are devoting themselves to the marking down of the breeding-places of the definitive host, supplemented by the clinical use of the microscope, and it is to be hoped that systematic observations sustained throughout the different seasonal periods of the year and in varying climatological and geographical areas, will afford valuable evidence, which will either serve to confirm or to suggest the inadequacy of the latest theory to explain all the established facts of the natural history of the disease.

Just as the remarkable discovery of James and Low of the living filaria in the probosces of different genera of mosquitoes, although suggestive of one means of infection, cannot be accepted as excluding the possibility of a water-borne infection, so also must we hold with Manson,* with regard to malarial infection, by direct inoculation by the bite of mosquitoes, "that this is the complete story is by no means sure." Referring to places which are practically uninhabitable on account of malaria, "and where there are few human inhabitants, if any," he asks pertinently, "if man be a necessary factor in the malaria cycle, how are we to account for malaria in such districts?" To this he replies

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* (Volume VIII, Allbutt's System of Medicine, Appendix of Malaria.)

that it is possible that, in such places, some other vertebrate may take the place of man, or it may be that the intervention of a vertebrate is not indispensable, the malarial parasite passing direct from one generation of mosquitoes to another, just as the sporozoal parasite of Texas fever is transmitted from the parent to its offspring. In connection with outbreaks of malaria associated with the excavation of the soil in engineering works, he finds it difficult to explain how mosquito activity can be specially affected by the turning over of a few feet of earth, and he recalls Ross' observations on the highly resistant "black spores," and suggests that these may represent a "resting" stage of the parasite, which may remain dormant in some, as yet, unascertained medium for an indefinite time until the unknown appropriate conditions arrive for their re-entry into the pathogenic life-cycle.

Smith, so well known in connection with the study of Texas fever, holds a similar view of the possibility of an alternative mode of infection. During the short time that has elapsed since these suggestions were published, the labours of the large number of investigators now in the field have gone far to modify them; and to one or two points, notably the direct transfer of the parasite from one generation of the mosquito to another, tho results of recent research are altogether opposed; it may be said that the direct inoculation theory holds the field, and that the *onus probandi* of an alternative mode of infection rests upon those who would take exception to the former view.

Every honest observation must be welcomed than can be urged and duly substantiated on the one side or the other of the question, the solution of which will indicate practical methods of prevention, and it is on this account that an enquiry recently made by Captain Rogers I.M.S., into the conditions obtaining in a notoriously malarious locality on the bank of the Hooghly, near Calcutta, have a suggestive interest; that is to say when we bear in mind the close analogy that obtains throughout the life-histories of the parasites of malaria and filariasis, and take into account the evidence which connects the latter disease with the drinking of infected water.

For if the evidence of the conveyance of infection by drinking-water should ultimately be disproved, we cannot surrender the established facts of the influence of the environment, of which the drinking-water is a prime factor, upon the prediposition of the human organism to disease. The removal of this predisposition is the fundamental principle of the prevention of all infectious disease, and as has been well said by a philosophical hygienist, "where the danger of fire is great, the extinction of myriads of individual sparks will always be less valuable service to the community than the intelligent construction of the house and the adaptation thereof to existing conditions."

The question Captain Rogers set himself to determine was the proportion of persons, in different parts of the area, who were at the time suffering from the effects of malaria as indicated by the enlargement of the spleen, and to this end, between five and six thousand persons of all classes and ages were examined. In addition the water level was measured in as many wells as could be found, and enquiries were made as to the height to which the water rises in these wells during the rains. The main drainage channels of the area were examined; the drinking-water supplies of the different communities were enquired into and carefully noted; and, lastly, returns of the number of cases of fever treated each month of the year in most of the public dispensaries were obtained, and compared by means of charts with the monthly rainfall of recent years, with the object of ascertaining if there be any definite and constant relationship between the amount and distribution of the rainfall and the prevalence of malarial fevers. It is unnecessary here to follow Captain Rogers in the account he gives of the precautions taken to secure a fair average approximation to the relative prevalence of enlargement of the spleen among the inhabitants of the different towns and villages included in the arear surveyed. He gives a suggestive table contrasting the "spleen percentages" in the municipalities located in two areas, running roughly parallel from north to south, one being situated on the east bank of the Hooghly river and the other still further to the east, at distances varying from two to twenty-six miles from the former. The spleen percentages in Group I ranged from 11·2 (in Cossipore-Chitpur) to 37·8 in Titagarh, with an average for nine municipalities of 24·5. Whereas in Group II the percentages varied, with one exception, from 32·3 in south Dum-Dum to 68·1 in north Dum-Dum, with an average for eight municipalities of 41·0.

The one exception referred to in the latter group was Maniktala, only 13·2 per cent. of the inhabitants of which were found to suffer from enlarged spleen, a rate comparable with that of Cossipore-Chitpur in Group I. It may be added that the average death-rate from "fevers" recorded in the Sanitary Commissioner's reports bears a close relationship,

as regards the relative incidence, to the "spleen rate." The average "fever" death-rate for the last five years in Group I is 21·3, that for Cossipore only 9·1; while in Group II., excluding Maniktala, it is 23·3, and for the last-named place only 8·2.

It would therefore appear that, by comparison, the towns situated immediately on the east bank of the Hooghly are relatively healthy, and that directly we pass into the lower lying tract to the east we encounter strong evidence of conditions that give rise to intense malarial infection, but with the one notable exception named. Maniktala, situated on extremely low-lying and water-logged land, has nevertheless a spleen rate, and a fever death-rate, approximating to the lowest in the healthier area. Captain Rogers then proceeds to an analysis of the various local conditions under which these communities live, and concludes that the lowest spleen rates are invariably associated with one common factor, viz., a good filtered water-supply. At the same time he is careful to allow that position in regard to water-logging is a factor to be taken into account. A closer analysis of the spleen rate in different wards of the same municipality lends support to this view, and helps to explain apparent divergencies from the rule in certain localities which are only partially supplied by the water-works of a neighbouring local board. The descriptions given of the local conditions prevailing in both Maniktala and Cossipore-Chitpur leave no doubt that none of the recognised factors in the production of malarial disease are wanting. They are the most "water-logged" of the whole series, the ground water-level being on the average only five feet from the surface in February, and in both places it is said to rise to within one or two feet of the surface in the rains; the areas are studded with open tanks, and the larvæ of anopheles were found in abundance. These two towns, as already stated, differ from the rest in two particulars only, viz., in the possession of a filtered water-supply, and in the comparative freedom from the evidences of malaria. Where, further, certain well-defined parts of other towns yield approximate results in regard to the percentage of cases of enlarged spleen, such relative immunity is associated with a similar water-supply. On the other hand, the towns which are entirely dependent on open surface tanks for drinking water yield, without exception, the highest spleen rates, while river water supplies appear to be associated with intermediate rates; the tabulated results indeed go to show that the average rate for river-water drinkers is double, while that for tank-water drinkers is nearly treble that found among the consumers of filtered water.

It was impossible in the time at command to search all the pools and tanks in an area of many square miles, and it was therefore decided to map out all the surface water collections in a smaller typical area and examine them systematically, and a portion of Maniktala was chosen for this purpose. The larvæ of anopheles were found in abundance in tanks containing fish, in smaller pools, and in roadside drains which were supplied with water from the water-service stand-pipes, a fact of interest as bearing on the question of a suggested increase in the fever-rate in certain localities elsewhere, subsequent to the introduction of filtered water-supplies. It may be admitted that figures can be quoted in support of such an increase, and if the increase were real it is obvious that the view put forward by Captain Rogers would be directly traversed, and that a cogent argument would be adduced in favour of the direct inoculation theory of malaria infection. This is a question which is being investigated, but it may be advisable to indicate some of the difficulties attending an enquiry apparently so simple.

The causes of an increased death-rate subsequent to the introduction of an improved water-supply may be roughly distinguished as apparent and real; apparent where the increase is due to misleading figures, and real where there has been an actual increase in the ratio of deaths. As regards the former, we must note that registration was, and is, defective nearly everywhere, and most of all in municipal towns, but it is gradually improving.

Registration may have been specially defective in a town up till the time when, a considerable capital having been sunk in water-works, the attention of the local authority is aroused, greater interest is taken in the collection of vital statistics, and the recorded rates rise.

In every case disturbance is caused by the increase in population during inter-censal periods; the ratios, if the deaths continue only to be registered in the same proportion, must get apparently higher, though the actual death-rate may be really lower. A similar disturbance may be caused by an alteration of the municipal area to include or exclude either a very healthy or a very unhealthy suburb; in such cases comparison of the figures before and after cannot reasonably be made. A population may increase by immigration as a direct result of the convenience created by the introduction of water-works, and the ratios calculated on the census population will be vitiated.

Real increases may be brought about in cases where, although the supply is new, there is no improvement in the quality of the water consumed, and again where other causes enter to nullify the good effect of the improved supply. For instance, where the new supply exists side by side with the old, which is practically the case nearly everywhere, there is a tendency for the latter to become worse because less attention is paid to its conservancy. The average consumption per head in the large towns now in possession of water-works is obviously inadequate for all purposes, and natives have hardy prejudices in favour of their own house-wells for the supply for personal consumption. Again, a good public water-supply is open to very special risks, and if not under competent survey and management may disseminate widespread disease. Instances of factors which go to nullify the expected benefits of a good public system are where no arrangements are made to carry off the increased amount of water and waste introduced; water-logging of the soil from inadequate drainage results. And lastly, as a result of the introduction of a good and convenient water-supply, there may be overcrowding in certain parts of the town and deteriorated health, especially among infants, who furnish, roughly, from one-fourth to one-third of the total number of deaths.

It will be seen that in order to distinguish the real from the apparent effects of the introduction of a new system of water-supply, investigation must be very carefully and shrewdly conducted on the spot, in each case, by persons who are thoroughly acquainted with all the facts and competent to appraise their value and effect.

To return to the Bengal investigation: it is stated that just half of the 30 tanks in the area mapped out contained the larvæ of anopheles, in spite of the fact that all contained fish, a co-existence confirmed by observations made elsewhere. It is however to be borne in mind that the search was carried out in February, a time when fever is at its minimum prevalence, and it may possibly be that the particular species of anopheles found is not an effective host for the parasite, or that these were not, at the time, harbouring the parasite; further observations in this area will, it is hoped, be made during the ensuing rainy season and autumn when fever is rife.

Lastly, a comparison of the fever rates, based on the returns of ten of the principal dispensaries for the last six years, with the monthly rainfall records, when both were plotted on charts for the different areas, failed to indicate any definite relationship between the two; nor was a similar attempt to trace the effect of waterlogging of the soil, as indicated by the ground water-level, more successful.

It is to be observed that enlargement of the spleen is rather an evidence of past and confirmed malarial infection, than of the present active phase of the disease, nor does the present stage of our knowledge permit us to affirm an exclusive casual relation between the one and the other; and the value of these observations, which require to be confirmed elsewhere and to be supplemented by a laborious comparative series of clinical blood examinations, must at present be held to be, so far, discounted. What they certainly go to prove is that chronic enlargement of the spleen is definitely associated with the drinking of impure water, and so far as we can eliminate all other casual factors in the production of this pathological phenomenon, by so much will Captain Rogers' main thesis be established. At the same time the very striking relation between the spleen-rate and the death-rate from "fever" in the locality in question is very difficult to account for on any other hypothesis than that the former is a definite index of the prevalence of malaria. Again, it may be admitted that the evidence derived from the collation of meteorological and vital statistics is of a very doubtful value, where the diagnosis of fevers is unreliable, and where relapses cannot be distinguished from fresh infections, and no solution of a problem of such complexity can be expected from such data *per se*; but, under certain circumstances of time, place and observer they may have a real contributory value, when combined with research into the seasonal and local distribution of the definitive host, when we bear in mind the influence of meteorological factors on both the host and the parasite. It may be added that a recent writer in the *Berliner Klinische Wochenschrift*, in discussing the subject of malarial fevers in the Prussian army, comes independently to the suggestion of an apparent association between the general prevalence of the disease and the quality of the drinking-water consumed.

Meanwhile it is satisfactory to note that the clinical and pathological aspects of the subject are not neglected. The excellent work of the late Captain Murray, I.M.S., on the Punjab fevers,* has been followed recently by a careful and instructive investigation by Captain Fearnside, I.M.S., into the fatal form of malaria which has long been prevalent in

* "Scientific Memoirs by Medical Officers of the Army of India," Part X, 1897.

the Central Jail at Rajahmundry (Madras). The persistent heavy death-rate in this institution had been ascribed to Beri-Beri, and in the lucid summary the author presents of the medical history of this large institution we encounter the familiar problem of the etiology of a fatal form of fever, the outstanding symptoms of which are a combination of anæmia, dropsy, and an ill-defined neuritis. The subject is one of great interest, not only for its local and intrinsic importance, but in view of its bearing on the question of the pathological significance of certain forms of tropical disease which have been confused and have given rise to controversy, viz., Beri-Beri, Kala-Azar, Anchylostomiasis and pernicious malaria.* It is impossible within the limits of the space at command to follow Captain Fearnside throughout the exhaustive discussion he submits of his clinical and pathological observations. In a critical analysis of the results of 407 autopsies, he presents a vivid survey of the more remote effects of chronic malarial infection upon the various organs, and thereby elucidates the varying clinical aspects of a fatal form of disease which is familiar to medical officers of jails, and which when widely prevalent among the population at large, in certain areas, has been referred to different specific causes. This is supplemented by a careful account of the numerous examinations of the blood and of the intestinal dejecta made in cases representing every form of fever, including a large number of cases that would previously have been classed as Beri-Beri. One or other form of the malaria parasite was found in all, while the presence of the *ankylostoma duodenale* was established in 75 per cent., and an analysis of the research shows how constantly the supposed Beri-Beri was associated with the malignant varieties of the hæmatozoon in combination with the duodenal worm. An interesting observation is the fact noted that prisoners belonging to certain indigenous hill tribes are specially prone to harbour a malignant crescent-forming parasite; in times of scarcity large numbers of these poor people are admitted into jail, and the more fatal form of the disease becomes epidemic. Further observations with the object of elucidating the phenomena of relapses and of re-infection are being carried out; meanwhile Captain Fearnside has confirmed Ross' experiments on the proteosoma-infection of birds and on the development of the human parasite in anopheles. Altogether this research has a notable value as being the first endeavour to study the ravages of malaria in a large Indian prison under scientific conditions.

Mediterranean or Undulant Fever.—Those who have devoted study to the etiology of Malta or Undulant fever have long held the opinion that the distribution of the disease is not confined to the shores and islands of the Mediterranean. The simple clinical test made available by the ingenuity of Professor Wright of Netley had, so long ago as 1897, demonstrated the existence of the disease in patients invalided from India, no less than 10 cases in the first instance having yielded the specific reaction. These and subsequent observations which are summed up in an article by Captain Lamb, I.M.S., in the *Indian Medical Gazette* for September, 1900, leave no doubt that Undulant fever has a very wide distribution in the tropical and sub-tropical zones, cases having been identified in places so far apart as Puerto Rico in the West to Calcutta in the East. It is a notable fact as regards its distribution that in India it has been found in a large and increasing number of cases, not only in the large towns of the plains, but also in the hill stations of the Himalayas at an altitude of 7,000 feet.

There is already abundant evidence that the disease is not confined to Europeans; although observations on natives of this country have only recently been begun, there can be no doubt, from the positive results already obtained, that they are by no means rarely affected. Many cases of so-called simple continued fever of malarial remittent and of aberrant typhoid fever will doubtless be rescued from the limbo* of this unsatisfactory classification, and while further observations on the distribution and the prevalence of the disease must be awaited, we may even now anticipate an important advance in our knowledge of a class of fevers that has long reproached our ignorance, and our nosology.

Cerebro-Spinal Meningitis.—A reference to page 91 of this Report will afford some information as to the occurrence of Cerebro-spinal meningitis in the jails of India during the last few years.† It cannot, however, be reasonably doubted that this is a disease with which we have long had to reckon, but which has, until comparatively recent years, eluded diagnosis. Hirsch, whose survey of its geographical distribution extends to the year 1886, takes no account of its occurrence in India, but the annals of

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* *See* article Kala-Azar, Section X, Annual Report of Sanitary Commissioner with the Government of India, 1897.

† Not reprinted in this Abstract.

epidemiology afford striking evidence of outbreaks, which in the light of recent knowledge, must be referred to this specific infection. For instance, the outbreaks of the "new fever of a pernicious type" in Wardha (Central Provinces) in 1881 rendered classic by an extended reference in Creighton's *History of Epidemics*, must now be classed as one of epidemic cerebro-spinal meningitis. Not only as regards the clinical symptoms, but in respect of the general conditions accompanying the epidemic, we find a striking agreement with those which recent experience has taught us to associate with outbreaks in this country. But it is among the medical records of the jail population that, as might be expected, we find the most definite and undeniable evidence of the disease, while characteristic outbreaks are of constant occurrence among the emigrant coolies who congregate at the Calcutta depôts for embarkation for the West Indian plantations. A careful account of the first recorded cases in India is given in a paper presented to the first Indian Medical Congress (1894) by Surgeon-Lieutenant-Colonel Moorhead, I.M.S., and the record is summarised and supplemented by Major W. J. Buchanan, I.M.S., in the *Journal of Tropical Medicine* for August, 1898, and in subsequent articles in the *Indian Medical Gazette*. To the latter officer must be ascribed the credit of establishing the identity of the disease as met with in India, with the cerebro-spinal meningitis of America and Europe, by the discovery of the *diplococcus intracellularis* (Weichselbaum) in the cellular elements of the fluid withdrawn by spinal puncture, his results having been confirmed by the Professor of Pathology at the Calcutta Medical College. And it is to further observations on the etiology of the disease made by Major Buchanan and Captain Stevens, I.M.S., during recent outbreaks in the Bhagalpur Jail that it is desired to draw attention.

Since January, 1897, this jail has been the scene of a succession of cases, 47 in all, which may be grouped into three distinct outbreaks; the first from January 11th to April 18th, 1897; the second from October 17th, 1897, till April 20th, 1898; and the third from August 22nd, 1899, till August 1900. The monthly incidence is important and was as follows: January, 2 cases; February, 2; March, 5; April, 25; May, 2; June, none; July, 2; August, 1; September, 1; October, 3; November, none; and December, 2 cases. It may be mentioned that the average annual rainfall of Behar is approximately 50 inches, falling on an average of 75 days. In the whole November-April period, 6 months, there is an average fall of only 2·3 inches and only 8 rainy days altogether on the average. The months of March and April are distinguished by having by far the greatest daily range of temperature, with an average minimum of 63° (Blandford).

Major Buchanan, starting with the assumption that the *diplococcus intracellularis* is the cause of the disease, was struck by the fact alleged by Germano, as the result of his researches into the viability of pathogenic organisms in dust (*Zeitschrift für Hygiene*, XXVI, pp. 228-291), that this diplococcus is the most resistant of all known pathogenic microbes to the effect of natural drying processes, and consequently the most viable in dust, "and capable of setting up infection in this way." Captain Stevens had independently arrived at the conclusion that there exists a direct connexion between dust and the disease in question. Enquiry was directed to the nature of the occupations of the prisoners attacked, and it was found that out of an average daily strength of some 650 men employed in labour which exposed them to dust in a marked degree, 44 out of the 47 cases occurred; only 3 cases, therefore, remain to be accounted for among a population, averaging 1,000 in number, whose work was done in comparatively dust-free surroundings in the clean factories whose walls and floors are coated with moist clay, constantly renewed. It is also noted that certain classes of prisoners who are habitually confined in certain parts of the jail enclosure, which are surrounded by high walls built close to the barracks, have hitherto been free from attacks. On the other hand twenty-four of the cases occurred amongst men exposed to wind-borne dust in road making, gardening, sweeping, building and dismantling old buildings, digging and working lime-kilns. No less than 16 cases arose among those occupied in "paddy-husking," in wheat-grinding and in cleaning food-grains; the remaining 4 are noted as cook's attendants, who are exposed to an atmosphere thick with dust. It will be remembered that the epidemic among the Soudanese troops in Khartoum in 1898 was associated with the work of dismantling old eastern houses and of removing the dust-laden roofs thereof.

The marked incidence of the disease in the dry, rainless months strongly supports this *prima facie* view of a connexion with germ-laden dust; sporadic cases of the disease among the general community outside the jail are known to occur, and many doubtless remain undiscovered owing to the absence of skilled medical attendance. The seven cases

recorded in the monsoon period (June to October), occurred among prisoners employed in cleaning stored food-grains. April, the month of election for the disease, is notoriously the period of drought and strong west winds.

The type of all outbreaks in the Indian jails appears to suggest an epidemic source of infection; the same institutions are repeatedly attacked, while information is accumulating of synchronous sporadic cases among the general population in the immediate environment. At the same time the evidence of infection direct from case to case is difficult to establish; cases drop in at intervals with no apparent connexion *inter se* and no widespread general epidemic occurs. Lastly, removal of a community into open camp has in several instances failed to influence the cause of the disease, and although overcrowding may undoubtedly be a factor in its spread when once it has entered a barrack, as is to be expected in the case of an acute specific fever, the "cause" of which is contained in the nasal discharges, yet enquiry as to any definite relation with overcrowding has generally yielded negative results. In many respects a likeness to epidemic pneumonia suggests itself. It cannot, however, be doubted that in the recognition of this disease—and further observation will assuredly demonstrate that it is more widespread than our present scanty records would indicate—we are enabled to differentiate one more specific infection from the mass of tropical fevers. It is quite possible that some of the fatal cases returned as heat-stroke, heat-apoplexy and sunstroke, as well as some recorded as simple meningitis, may really be due to the disease in question. The routine observation of "Kernig's symptom" in all such cases would be a useful addition to other clinical tests, for although it may not prove to be absolutely pathognomonic for specific cerebro-spinal meningitis, the best authorities in this country are inclined to attach great diagnostic importance to it.

Enteric Fever and Dust.—It need scarcely be said that too much stress is not to be laid upon these scanty and purely epidemiological considerations, which must be held to have merely a suggestive value as indicating a promising field for exact research. Some striking evidence in connexion with the excessive prevalence of enteric fever among the European troops at Quetta in 1898, which has suggested a casual relation between infected dust and the disease, has led a recent writer to look into the seasonal incidence of enteric fever as it occurs in certain of the large geographical "groups" with the result of further emphasizing the possibility of this source of infection. And it is true that if certain selected areas are taken, and if the admissions to hospital are plotted upon a scheme with the rainfall, there appears to be a notable incidence of the disease upon the rainless months of the year. But the limitations of the epidemiological method of enquiry are soon exposed, if we pursue the enquiry into other areas and over a series of years with their varying meteorological conditions. The factors are extremely complex and the data unreliable; while, for instance, the terms simple continued fever and remittent fever are still in use to a very large but unequal extent, it can scarcely be doubted that while many cases of enteric escape recognition, other specific forms are therein included, *e.g.*, Malta fever. But beyond this it will be found that the seasonal incidence of the admission for enteric gives a characteristic but different curve in nearly every separate geographical group. Whereas in the Punjab and on the frontier, the disease appears to be strictly limited to the rainless months and to vanish with the onset and continuation of the light and intermittent rainfall, on the other hand, in the Bombay Command it is decidedly most prevalent during the heavy and continuous monsoon weather; while in the North-Western Provinces and in Southern India there is a marked double rise in the curve,—one during the dry, hot weather, and the other during the rains—suggesting the possibility of the influence of dust in the one case, and of pollution of the water supplies in the other. Many questions are opened up, *viz.*, the nature of the soil, and of the water-sources, the height and fluctuation of the ground-water in polluted soil; for on a friable polluted soil with deep wells and a low ground water, dust might reasonably be expected to be a vehicle strongly open to suspicion, whereas on a consistent clay or rocky soil with surface water-supplies, the flushing of the polluted surface by rainfall would point to the probability of the infection of the drinking-water. There are, of course, other factors to be taken into account, such as the greater or less prevalence of flies at different seasons and in different places, but enough has been said here to show that the problem is a complex one, and not to be solved by an appeal to certain broad epidemiological facts, though these doubtless have their value.

Fevers in the Kumaon Hills.—Finally, a brief reference may be made to the observations made during a visit to the Kumaon hills in 1899, by Captain Rogers, I.M.S., into the disease called "sanjar" by the natives, and which has been thought to signify the endemic bubonic plague of these highlands. It is true that previous enquirers have

endeavoured to distinguish between "sanjar" and "mahamari," but hitherto they have had to rely on the confused statements of the ignorant survivors, as intelligence of an outbreak of fatal disease in these small and remote communities is long in reaching the authorities, and competent medical aid is not immediately available.

Captain Rogers was more fortunate, and his description of the clinical course of the fever and his discovery of the *Spirillum Obermeieri* in the blood of a patient have made it clear that "sanjar," in one of its forms at least, is true relapsing fever, although the term is applied indiscriminately to various infectious diseases which find all the conditions favourable to their rise and propagation in the intensely insanitary surroundings of these poor hill-folk.

The term "mahamari," on the other hand, connotes a more fatal and fulminant epidemic, either true plague, or typhus, or even cholera, and it is hoped that timely information of the next outbreak will make it possible to investigate the subject further.

Preventive inoculation for Enteric Fever.—In concluding these discursive remarks on recent progress in our knowledge of Indian fevers, it will be interesting to give some figures showing the results attained so far by the process of inoculation for enteric fever introduced by Professor Wright of the Army Medical School, Netley. It will be observed that the results of the operations have been compared in two series, *viz.*, in the corps in which inoculations were carried out and in the whole body of the European army, in order to obviate any fallacy which might arise from a comparison instituted between populations not exposed to the same conditions. It must be admitted that it is impossible to make a scrupulously exact comparison of the conditions which in their sum involve a liability to, or an immunity against, enteric fever. For exact deductions we should have to take equal numbers of men of sufficient daily average strength, of equal age-periods, and of equal length of residence in places equally presenting the sources of infection. But it is submitted that the numbers from which the present data are drawn are sufficiently large to compensate for the factors which tend to vitiate the ideal of an exact comparison, and even if it be held that their interest is, at this stage, rather of a provisional nature, the immense importance of the subject demands that every fact which tells for or against the process should be presented without delay.

Enteric Fever and inoculation in India in 1899.

European Army of India.	Strength.	Number of men inoculated.	Number of men not inoculated.	Cases of Enteric Fever.				Percentage to Strength.				Difference between A and B in favour of A.		Percentage decrease in favour of A.	
				Amongst the men inoculated.		Amongst the men not inoculated.		Amongst the men inoculated. A.		Amongst the men not inoculated. B.					
				Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.				
												A.	D.	A.	D.
Corps in which inoculations were performed	30,353	4,502	25,851	44	9	657	146	·98	·20	2·54	·56	1·56	·36	61·4	64·3
European army of India ...	67,697	4,502	63,195	44	9	1,348	329	·98	·20	2·13	·54	1·15	·34	54·0	63·0

It is to be noted that so far as these figures go, the value of the process is demonstrated most notably on its prophylactic side; as regards the case mortality, however, there is also some appreciable difference. Among the inoculated it was 20·45 per cent., while among the uninoculated it was slightly higher, *viz.*, 22·22 per cent. in the corps in which inoculations were performed, while 25·14 per cent. in the army as a whole. For the rest the table may be allowed to speak for itself.

Tuberculosis in India.—In the Appendix to this section in last year's report some remarks by Lieutenant-Colonel Crombie, M.D., I.M.S., on the subject of tuberculosis in India, were included in a report made by that officer on the proceedings of the Congress on Tuberculosis held in Berlin in May, 1899. The general conclusion arrived at was that the disease was notably less prevalent, especially among children, in India than in Europe, but at the same time an increase among the jail section of the population was not overlooked. There are obvious reasons why the pathology of fatal disease among the

large adult population of Indian jails should be more closely followed and accurately recorded than is the case for any other class; prisoners are constantly under medical supervision, and in all fatal cases a post-mortem examination is the rule. As long ago as 1848, Alan Webb pointed out how easy it was to overlook tuberculosis in natives dying of dysentery, diarrhœa and other wasting diseases, and it must be admitted that an examination of the jail death returns from phthisis pulmonalis for the last 20 years leaves some doubt as to how far the very decided and progressive rise therein shown connotes a real increase, or to what extent it depends on more accurate diagnosis. Subjoined is a tabular statement that may assist in throwing some light on the subject; it gives the ratios per 1,000 of deaths from tubercle of the lungs, and from anæmia and debility in each provincial group of jails for the last four quinquennial periods.

Ratio of deaths from Tubercle and Anæmia and Debility in jails during the four quinquennia 1880 *to* 1899.

Province.		Ratio of Deaths per 1,000 of Population during the Years.			
		1880–84.	1885–89.	1890–94.	1895–99.
Burma	Tubercle	1·47	3·18	2·51	3·51
	Anæmia and Debility ...	2·81	4·63	1·08	0·37
Assam	Tubercle	0·64	1·49	0·17	1·40
	Anæmia and Debility ...	4·13	4·43	4·63	4·26
Bengal	Tubercle	4·14	3·39	2·72	3·41
	Anæmia and Debility ...	3·80	1·92	1·55	0·93
North-Western Provinces and Oudh.	Tubercle	1·84	1·81	1·80	2·58
	Anæmia and Debility ...	1·73	2·27	1·97	2·78
Punjab	Tubercle	1·27	1·73	1·76	2·41
	Anæmia and Debility ...	1·91	1·02	0·33	0·29
Bombay	Tubercle	1·72	1·28	0·69	2·57
	Anæmia and Debility ...	2·25	1·82	2·36	1·03
Berar	Tubercle	1·09	1·37	0·77	1·32
	Anæmia and Debility ...	0·47	0·58	0·96	3·20
Central Provinces ...	Tubercle	0·90	1·36	0·38	3·73
	Anæmia and Debility ...	6·58	5·73	2·15	3·92
Madras	Tubercle	1·60	1·88	1·46	3·22
	Anæmia and Debility ...	3·42	2·35	2·50	0·12
All India	Tubercle	1·63	1·94	1·38	2·68
	Anæmia and Debility ...	3·01	2·75	1·75	1·88

Two important conclusions, at least, are deducible from these figures, viz., first that improved diagnosis has contributed largely to the nominal increase in the tubercle death-rate, for we see that as this latter rises the deaths allotted to anæmia and debility decline in approximately equal ratio, the combined death-rate from the two causes being much the same in the first period as in the last. And, secondly, we arrive at the fact, which is contrary to the accepted belief that the death-rate among adult natives of India living under excellent hygienic conditions is notably higher than that of England and Wales

among the population of the same age-periods, viz., 15–55. In India the ratio per 1,000 of average strength in 1899 was 2·49, while for England and Wales in 1898 it was 2·04.* There is fortunately good ground for the belief that the increase is not real to any appreciable extent, and that the prevalence of the disease can be traced, not to the conditions of jail life, though these, doubtless, are not favourable to amelioration and recovery when the prisoner is admitted with the disease, but to the general low standard of vitality among the poorer classes who furnish the crimnal population. A vegetarian diet, poor in the nitrogenous and fatty elements, defects of clothing in a climate subject to an enormous diurnal and annual range and the overcrowding in dark, damp and dust-laden huts, which is the lot of the majority during the colder months and during the rains, are all factors acknowledged as the most potent everywhere as predisposing to the disease. It is perhaps needless to add that all possible measures of prevention are being employed.

Special Sanitary Officers for Commands:—In these reports for the last three years a *précis* has appeared of the results of the investigations of the three special sanitary officers, who have been recently attached to two of the largest military districts and to army head-quarters in India, and whose duty it has been to enquire into special outbreaks of disease, and to carry out experimental observations with a view to the elucidation of the chief sanitary problems in cantonments. Their work has been strictly practical in its aim, and the results have proved so valuable that in an order just published the Government of India have decided to increase their number to four, and to attach one to each of the commands. As heretofore, these officers will be selected from the Royal Army Medical Corps and will be required to have undergone special training in sanitary science and to possess a diploma in public health.

In addition to the appointment of these officers, and in order to ensure continuity of work in their laboratories during their absences, which must necessarily be frequent, arrangements will be made to associate with each of them a medical officer from the station hospital at their head-quarters, who will be relieved for this purpose of some of his ordinary duties. It is hoped that in the future these assistant officers will be usefully employed on sanitary work during field operations. With a view also to further extend the advantages of microscopic examinations and scientific advice in sanitary matters, small and inexpensive laboratories will be established at the head-quarters of each district (except the Punjab Frontier Force and Assam, where there are no British troops), under the superintendence of the medical officer in charge of the station hospital. The duties of the officers in charge of these district laboratories will be to conduct such investigations as may be within their powers, with special reference to sanitation, and to render assistance to the sanitary officer of the command whenever necessary. The latter will supervise the district laboratories, direct the efforts of the officers in charge, and encourage the development of bacteriological research as much as possible.

There cannot be any question that this action, taken on the advice of the Principal Medical Officer, Her Majesty's Forces in India, will be fruitful in important practical benefit to the health of the troops, and in contributions to the elucidation of the problems of tropical disease.

And further, it may be noted that the establishment and early inauguration of the Central Bacteriological Institute for India, is engaging immediate attention. There will probably be some delay before affiliated provincial institutes, which are to complete the project, become accomplished facts. But the scheme has been cordially approved and moves to completion, and the Government and the country are to be congratulated equally on a measure which cannot but prove to be of enormous benefit to medical science, and so promote the common weal.

The Pasteur Institute.—The public-spirited enterprise of the private association formed several years ago for the purpose of providing treatment for persons bitten by rabid dogs in India, on the Pasteur system, has at last achieved its purpose. On August 9th, 1900, the Indian Pasteur Institute was opened for active operations at Kasauli, a hill cantonment and sanitarium in the Himalayas, near Simla. This practical issue after years of effort is largely due to the active interest taken in the movement by the Principal Medical Officer, Her Majesty's Forces in India, who was able to place the services of Major Semple, R.A.M.C., at the disposal of the Committee, and already a large number of patients, both European and Native have undergone treatment at his hands.

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* Phthisis; Registrar-General's Report, 1898.

The Red Sea Pilgrim Traffic.—The quarantine station on the island of Camaran was opened for the reception of pilgrims for the Haj of 1898–99 on 25th November of the former year. The number of pilgrims from all parts accommodated during the season was 14,074, against 15,228 and 14,210 in the two previous seasons, respectively.

The continued presence of plague in India rendered it incumbent on the part of the Government of this country to maintain the precautions which had been enforced during the previous year, and which were fully detailed in this Report for 1898. Briefly, it may be recalled that the Notification of November 10th, 1898, ordained that no person resident in the Bombay Presidency (excluding Sind, but including its port, Karachi), the Mysore Presidency, Mysore, the Hyderabad States and Coorg, would be permitted to embark for Mecca from any port in India save Chittagong, and then only after a period of detention for medical observation. Local Governments and Administrations were further directed to advise all intending pilgrims to defer their journey until a more favourable season.

The effect of these measures in limiting the exodus from India was everywhere apparent. His Highness the Nizam of Hyderabad fell in with the views of the Government, and agreed that his Mussalman subjects should defer their pious journey; and in consequence of the limitation of embarkation to the one port of Chittagong, certain Javanese pilgrims who arrived at Bombay viâ Madras, and who were unaware of this arrangement, declined to prolong their journey to Chittagong and elected to return to Java forthwith.

A further precaution, instituted for the first time, was the disinfection of all clothing and effects before embarkation was permitted at Chittagong, a measure that appears to have been carried out very carefully and successfully.

As a consequence of these deterrent measures, moral and practical, only two ships were despatched from India with pilgrims during the season, and these left Chittagong on the 25th January and the 28th February, 1899, with 740 and 706 Hajjis respectively. Altogether 1,833 Natives of India and 70 Afghans arrived at Camaran to undergo quarantine, prior to proceeding to Mecca, as compared with 890 and 124 respectively in the previous year, the number in excess of those who embarked at Chittagong being accounted for by pilgrims from the Straits Settlements and from Persian ports.

On the arrival of one of the two ships from India at Camaran, a pilgrim who had been under treatment for asthma and remittent fever during the voyage, which occupied some 46 days, was suspected to be suffering from plague, and an examination of his sputa is alleged to have revealed the presence of the specific bacilli. Doubt is thrown upon the diagnosis by the vice-consul at Jeddah, a medical man, and it is satisfactory to record that no other case, either on board the pilgrim ships or in the Lazaret, gave rise to suspicion that the disease had escaped the vigilance of the authorities.

Plague was, unfortunately, present in Jeddah, the first case having been discovered on the 22nd February, 1899, that is long before the arrival of pilgrims from India. Pilgrims were nevertheless allowed to enter the town, but only for the briefest period compatible with the necessary business for the necessary journey to Mecca, and no case of the disease was reported among the natives of India. One or two cases of plague are said to have occurred at Mecca itself, but they were clearly imported from Jeddah.

Return of the Pilgrims.—Three vessels left Jeddah for the port of Calcutta during the year, from one of which the pilgrims were landed, contrary to instructions, before inspection by the Health Officer. The other two brought 748 Indian pilgrims, who, after inspection and thorough disinfection of their effects and clothing, were despatched by rail under police escort to their destinations. Javanese pilgrims, to the number of 338, were not allowed to land, but transferred at once to a vessel which sailed forthwith for Singapore. The health on board these ships during the return voyage had been exceptionally good. Eleven vessels, bringing in all 862 pilgrims from Jeddah viâ Aden and other routes, entered the port of Bombay during the year. Only five deaths had occurred among this number during the voyage, and these were clearly attributable to privation, there being no case of infectious disease. The baggage and clothing of all was disinfected on arrival at Bombay; the pilgrims living up-country were not allowed to enter the city, but were sent direct from the ships to their homes by rail at the expense of the Government.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1899.

(*Lieutenant-Colonel W. G. King, C.I.E.*)

General Population.

4. According to the census of 1891, the population of the Presidency is 35,641,828 (inclusive of Europeans and Eurasians); the estimated population is 38,256,526. 185,814 souls emigrated during 1899 to places beyond the Presidency, against 245,862 in 1898. Immigrations, when balanced against these figures, show that a decrease of the population occurred to the extent of 23,394. The "natural increase" of the population was 373,499. Of the total census population—which, unless otherwise stated, is referred to hereafter—only 33,565,859 inhabit areas where registration is conducted; or, in other words, of a population of 2,075,969 no vital statistical records are maintained. These represent chiefly inhabitants of mountain ranges, where the subordinate administrative machinery is not of the class that would enable a system of registration to be conducted efficiently. Necessarily, efficiency of registration in this Presidency is less in rural areas where registration is not compulsory than in municipalities, where it is so. Difficulties in rural areas are further accentuated by the existence of large tracts in several important districts, which are under semi-independent administration; from these, the punctual submission of statistical returns has ever been a matter of difficulty for the District officers concerned to enforce. In these special cases, as remarked in former reports, much improvement may be expected on the introduction of the Village Proprietary Act. In the meantime, more especially since 1897, Government has considered various proposals for the improvement of registration in rural areas. An outcome of these considerations has been the passing of the "Madras Registration of Births and Deaths Act" of 1899. Under this Act, it is intended not to at once bring under influence the whole of the rural tracts, but such as may from time to time be selected by Government. Registration of births and deaths is rendered compulsory. Provision is made for the appointment of Registrars, and for the granting of extracts from the registers free of charge. The latter is a point, the legal importance of which the average uneducated native is quite capable of appreciating, and which will therefore probably conduce greatly to the popularity of the measure. The difficulty in finding a sufficiently educated staff to secure a marked improvement even under the influence of this Act is, however, apparent, as anything approaching a specially organized staff would present financial difficulties not likely to be overcome. In the meantime, indubitably, ever increasing attention has been paid to the subject of correct registration by the Revenue Department. In inspecting the birth and death registers, the Revenue Department continues to receive material aid from Deputy Inspectors of Vaccination, District Medical and Sanitary officers, and from this office. During the year, the attention of Collectors was specially invited to the condition of registration in various villages within their respective districts in 78 instances. In the case of both districts and municipalities, irrespective of personal examination of the registers during ordinary inspection duties, I make it a point to draw attention to the variations in monthly returns when compared with previous years, directly the vital statistical returns compiled in this office are available for exhibition of results.

Births in Districts.—The total birth-rate for the Presidency is the highest on record, namely, 31·3 per 1,000. The following table shows that, with the exception of the deficient birth-rate for the year 1898 (which it was pointed out in the report for that year was due to the influence of famine on the population during 1896-97), there has been a

steady increase in the birth-rate registered—a result that must be ascribed to better attention to registration by all concerned :—

Table showing the total birth-rates for the Presidency from 1892 *to* 1899.

Years.	Birth-rate on the census population.*	Birth-rate on the estimated population.*	Years.	Birth-rate on the census population.*	Birth-rate on the estimated population.*
1892	25·1	24·4	1896	29·1	26·8
1893	26·9	25·9	1897	25·3	23·0†
1894	27·7	26·2	1898	24·6	22·0†
1895	28·9	27·1	1899	31·3	27·4

* Inclusive of Europeans and Eurasians both in the births and population.
† Famine influence.

It would, of course, be possible to ascribe this increase to the larger population dealt with in the inter-censal period than apparent when rates are reckoned upon the census population. I have, therefore, side by side with the results upon the census population, shown those on the estimated population. It will be seen that an increment is s evident that bears out my assertion.

Of a total of 22 districts, only Madura, South Arcot, Tanjore, Madras and Trichinopoly, exhibit a slight decrease ; in all other cases an increase in the birth-rate is shown. The rate is remarkably high in districts that suffered from famine in 1896-97, and where, consequently, there had been an increased infantile death-rate, and later a decrease in the birth-rate when compared with the previous year, although still below the average of these districts. The great feature in the severe famine of 1877 was that the adult population suffered severely, with the consequence that the birth-rate was decreased for a series of years, until the influx of a young population reaching the child-bearing age suddenly caused the birth-rate to rapidly increase, so that, whilst in the census of 1881, it was held that the normal birth-rate of the Presidency was 42·45 per 1,000, in the census of 1891 it was suggested that for at least a period it must have attained the rate of 55 per 1,000. But such conditions as occurred in the 1877 famine are never likely to again be faced by the population ; the wide distribution of railways and the better methods of organization of relief are such as should not be followed by a material increase of the death-rate of adults. It is, however, unlikely that the methods employed will ever be sufficiently developed to prevent a depression of the birth-rate, and an increase of the infantile death-rate. On the return of prosperity the famine population subjected to such conditions must be expected, as shown in the present instance, to develop an increased birth-rate, so that a famine combated on modern lines must not be looked upon as a "natural check" to the increase of populations. For example, the following shows the strides made in the birth-rate in the districts which were affected by famine :—

Name of District.	Average of previous five years.	Birth-rate during 1898.	Average yearly increase or decrease of the birth-rate in the previous five years.	Actual increase between 1898 and 1899.
Anantapur	28·3	24·8	— 0·2	6·5
Bellary	32·8	29·3	— 0·2	5·5
Cuddapah	27·3	23·3	+ 0·1	4·6
Ganjám	21·9	22·9	+ 0·9	8·8
Malabar	21·6	18·6	— 0·3	7·4
Vizagapatam	27·4	23·8	+ 0·3	13·4

At the same time, it is not claimed that a reaction after famine is the sole cause, as the increase is exhibited in districts other than those named, although it must be remembered, as pointed out in last year's report, that the depressed birth-rate did not confine itself solely to districts where famine had been officially declared—others suffered in a less degree from the high prices of food-grains, and exhibited increase of the infantile

death-rate and decreased birth-rate. To increased care in registration must be ascribed much of the result. The occurrence of marriages that had been deferred must also have had influence.

103·9 births of boys were registered to every one hundred births of girls. According to races the birth-rates were as follows:—Native Christians 26·5, Muhammadans 29·9 and Hindus 31·5, per 1,000 of their respective populations.

Deaths in Districts.—The total deaths for the Presidency amounted to 675,094, giving a rate of 20·1 per 1,000 on the census, and 17·6 per 1,000 on the estimated population. The following table shows under causation the percentage due to each disease. To enable a comparison to be conveniently made, the table is extended so as to include the previous seven years:—

Years.	Birth-rate per 1,000 of population.	Percentage of deaths from						Death-rate per 1,000 of population.
		Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other causes.	
1892	25·1	10·5	5·8	37·4	4·3	1·5	40·5	22·3
1893	27·0	5·0	4·2	39·9	3·6	1·6	45·7	19·3
1894	27·7	6·3	1·7	40·2	3·7	1·7	46·4	20·0
1895	29·1	3·2	0·8	42·1	3·6	1·6	48·7	19·6
1896	29·9	7·1	1·4	38·6	3·7	1·6	47·6	20·6
1897	28·7	17·3	2·6	35·3	4·7	1·4	38·7	25·4
1898	27·4	9·4	2·9	35·6	4·2	1·6	46·3	21·0
1899	31·3	4·3	2·5	36·4	4·6	2·0	50·2	20·1

It is hopeless to attempt, under existing circumstances of registration, to criticise the death-rates reported from districts. They may possibly sink to the almost certainly ridiculous rate of 14·4 per 1,000 in Ganjám, or rise to nearly 30 per 1,000 in South Canara, without its being possible to state definitely what are the errors of omission and commission. The only criterion available is the approach to accuracy of the birth-rate, and the acknowledged existence of special diseases. One cause of deficient death-rate is certainly a tendency to ignore the deaths of infants below one year of age. This conclusion was forced upon me by the perusal of numerous abstracts of village registers furnished to this office by District Medical and Sanitary officers during their inspections. It was obvious that the death of an infant who had not managed to struggle through a year of life was often held unworthy of official recognition by the village officer, with the result of marring the total statistics supplied. To this subject I have drawn the attention of Collectors, and a demand for increased care by their village officers was promptly made by them. Although there is no reason to believe that the rate of 14·4 per 1,000 credited to Ganjám represents the facts of the case, it is evident a satisfactory fall in mortality has occurred. It will be remembered that in this district the fearful rate of 50·1 per 1,000 was reached in 1897—a result due to famine and small-pox, whilst in 1898 small-pox was again responsible for a heavy proportion of the total mortality, which amounted to 22·7 per 1,000.

Excluding Madras district—the circumstances of which do not permit it to be fairly compared with rural districts—the highest death-rate was registered in South Canara (29·9 per 1,000). This increased rate over the preceding year is accounted for by the larger proportion of fever registered. There is no reason to believe that the majority of these fever cases were not due to malaria, but it is well to remember that both in South Canara and Malabar typhoid fever is an acknowledged factor of the mortality amongst natives. In Bellary the increase of 1·9 per 1,000 over the previous year was due to the increased death-rate from cholera. In other instances the fluctuations with reference to previous recorded rates are of little importance, and in 14 out of a total of 22 districts, the variation represents a decrease.

It has been frequently remarked in the reports of this office that the rates for rural towns are specially untrustworthy, and the cause has been ascribed to the impossibility of

village officers attending to registration where the population had reached the limits which accompany the definition of a "Town," namely 10,000 inhabitants. It is specially in dealing with these towns that the benefit of the Registration Act of 1899 above referred to should be felt, if special Registrars be supplied.

The infantile death-rate was 159·0 per 1,000 of births—a result contrasting favourably with that of the previous year (163·3).

Births in Municipalities.—As in the case of rural areas, the total birth-rate of municipalities has shown an increase, it being 37·0 against 34·9 per 1,000 of the previous year. This result testifies well to better activity in registration in rural areas, where the increase over the previous year is 5·4 against 2·1 per 1,000 for municipalities. In both, the rates still fall far short of what, as already observed in discussing district rates, must be held as the standard birth-rate of this Presidency. The total average has been much impaired by such glaring instances of decline of the birth-rate as exhibited by Vellore (8·8 per 1,000) and Walajapet (8·4 per 1,000) below the average. In both cases the rates for the previous year were also unsatisfactory and showed a decline—due undoubtedly to careless registration for which there was no excuse—but in 1899, the obtaining of correct statistics must have been much impeded by the existence of plague in both towns. The continued low rate registered in Cuddapah is due to a large extent to the usual absence of fecundity in a population stricken with malaria. In face of the re-action in the birth-rate which has been exhibited in the district of Cuddapah (an increase of 4·6 per 1,000 over the previous year) and other areas that were effected with famine, it is exceedingly unlikely that the late famine still exhibits its influence upon the birth-rate of this town. Consequently, the absurd rate of 14·3 per 1,000—a decline of no less than 7·3 per 1,000 below the very poor average of 21·6 for the previous five years—must be regarded as very largely due to apathy on the part of the Municipal Council. Other towns showing notable decrease for which there is no reasonable excuse are Cuddalore, Madura. Mannárgudi, Palamcottah, Salem, Tirupati, Cochin and Conjeeveram. When compared with the previous year, it is found that increase of the birth-rate has been attained in 44 towns against 39 in that year. It is satisfactory to find that Cocanada, Berhampur and Parlákimedi, which for so long a period exhibited markedly inferior results, have now secured a better approach to the normal rate. There remains, however, much room for improvement. Of the total of 59 municipalities, 16 show rates above 30, 21 above 35, 11 above 40 and 5 above 45.

Deaths in Municipalities.—The average death-rate for the year has been 30·7—a decrease of 0·3 below the average for the past five years, and 1·2 below the previous year. In 28 instances there has been a decrease in the total death-rate; in 29, there has been an increase. In Anantapur and Palni, seeing that there has been an increase of the birth-rate, the fall to 16·5 per 1,000 from 21·0, and to 17·5 per 1,000 from 31·4, respectively, of the previous year is suspicious of imperfect registration of deaths, although the absence of epidemic cholera in Palni during the year under review contributes to the sharpness of the contrast. The same may be said of Dindigul where, although the birth-rate has increased 9·7 per 1,000 for the year, the death-rate remains the same as during 1898, namely 18·9.

In Masulipatam, Ellore, Máyavaram, Vizagapatam, Bimlipatam and Vizianagram the increased death-rate, when judged side by side with the increased birth-rate, merely implies better care in registration. In Karúr, Gudiyáttam, Salem, Vániyambádi, Kumbakónam, and Tinnevelly, the chief cause of increased mortality was cholera. In Vellore and Tiruppattúr, both cholera and plague caused the increase, whilst in Walajapet it was chiefly due to plague. In the Madras town, there was registered a satisfactory fall when compared with the previous year of 6·7 per 1,000, and of 0·3 per 1,000 below the average of the previous five years. Madras has, on account of the necessity for keeping it prepared for the advent of plague, never had bestowed upon it so great attention hitherto as to the executive details of sanitary administration. Seeing that the meteorological conditions were fairly normal in this locality, it is probable that beneficial influence has been exercised upon the general health of the people, although a decrease of 1·65 per 1,000 in the cholera death-rate has contributed mainly to this result.

The total average infantile death-rate for Municipalities was 223·9 per 1,000 of births, against 229·5 in the past year—a measure of improvement that may be ascribed to better ability of the people to obtain luxuries owing to easier prices of grains. The causes of high rate of infantile mortality in periods of normal prices of food-grains have, from time to time, been discussed in my Annual Reports, and therefore need not be now entered into. It suffices to remember that no more delicate test of the hygienic condition of a

population and its surroundings exists than exhibited by the infantile death-rate—more especially with reference to the cleanliness of the soil. Judged by this rough standard, theoretically, it may be concluded that the towns of Tinnevelly, Tuticorin, Masulipatam, Madras, Negapatam, Madura, Ellore, Bezwada, Chingleput, Kumbakónam and Periyakulam must possess foul soils, as in practice undoubtedly they do.

Chief Diseases.

Cholera.—The deaths from cholera were but 0·9 per 1,000 of the population, against 2·0 per 1,000 in the previous year. The greatest number of deaths occurred in Salem, where they amounted to 5,568 (2·8 per 1,000 of the population), in Tanjore, where they were 5,864 (2·6 per 1,000 of the population), and Trichinopoly, where they were 3,287 (2·4 per 1,000 of the population). As has been pointed out in former reports, the incidence of mortality was, as usual, in the south-west monsoon districts, greatest during the south-west monsoon, and in the north-east monsoon districts, during the north-east monsoon. Commencing with 1894, when the facts were illustrated by diagrams representing the average for the preceding ten years, with the exception of the slight variation in 1898, the truth of this observation has been annually proved by the statistics available.

In the 59 municipalities, the total deaths from cholera were 3,200 or 1·5 per 1,000 of the population. The greatest sufferers were Vellore, Gudiyáttam, Salem, Kumbakónam, Vániyambádi, Tiruppattúr, Máyavaram, Tinnevelly, Karúr and Ṭrichinopoly. All evidence received continues to point to the usually accepted fact that water contaminated with the specific germ is the chief method of local propagation of the disease. For example, the District Medical Officer, Salem (Captain Gabbett), states :—

> Cholera has been as usual widely prevalent in the district. The disease was prevailing in an epidemic form in the Atúr taluk from February to April and October to December, in Tiruchengode taluk from January to May, Salem and Tiruppattúr taluks from February to May, in the Námakkal taluk January to March, Krishnagiri taluk during August, Uttankarai taluk during October, and in the Municipal towns of Vániyambádi and Salem during January and February to April, respectively, causing in all 5,568 deaths in the district. The worst outbreaks are invariably in taluks where the population are chiefly dependent by necessity or choice on river water for drinking. The most typical instance of this occurred in the Atúr taluk. Every village along the banks of the river which runs the length of the taluk was affected. In addition to the civil apothecary and hospital assistant already in the taluk, two hospital assistants were sent there on special cholera duty. It was an impossible task to prevent use of the infected river water or its constant re-infection, and other measures where of little avail. In villages and towns dependent on well water-supply, cholera outbreaks have often been promptly checked by closing the infected well and preventing infection of other wells by appointing caste waterman and guards.

Medical officers continue to report favourably upon the use of permanganate of potash in specifically contaminated water sources, but point out that it is impossible to give definite statements, as disinfection of the water-supply often results in other sources being employed by the people.

Small-pox.—There was 16,991 deaths from small-pox. Of these, the largest numbers occurred in South Arcot (2,540 or 1·2 per 1,000 of the population), Madura (1,947, or 0·9 per 1,000 of the population), Gódávari (1,829, or 0·9 per 1,000 of the population), Tanjore (1,825, or 0·8 per 1,000 of the population), North Arcot (1,550, or 0·7 per 1,000 of the population). In regard to these figures it must be remembered that vaccination is not compulsory in rural areas, and although a large section of the population appreciates its benefits, there is still some repugnance in submitting to the operation. Even where the mothers have no objection to the operation, it is difficult to convince them that infants under one year of age can successfully bear the operation. Hence, the risk to infantile life is considerable, more especially as a Hindu mother considers it necessary to show respect to the goddess of small-pox by joining in assemblies in crowded rooms, where, in the presence of the small-pox patient, ceremonies are performed to the deity. Re-vaccination, which, as the population emerges from being but a partially protected to being a fairly protected population, must become of greater importance, is rendered difficult in advance by it being conceived that small-pox is a disease of infancy, from which the adult has little real cause to protect himself, a conviction obviously of the same origin as the

European estimate of measles, namely, that infection spares not the child but passes over the adult, who, it is apt to be forgotten, has usually acquired immunity consequent upon an attack of the disease in infancy.

The appearance of small-pox in a locality is at once followed by special vaccinators being deputed to the spot, but, unfortunately, it does not follow in certain areas that their services will be utilized by the people, as a distinct prejudice against vaccination being conducted in epidemics is often met with. Disinfection of infected houses and clothing is also employed. Much prejudice was encountered in the preceding year against vaccination, the people having hopelessly confused the operation of inoculation against plague with that against small-pox; or, put in other words, an opinion existed that plague was being spread amongst the people by inoculation under the guise of vaccination. Happily, what at one time threatened to be a serious cause of retardation of vaccination has now subsided, as a result of common sense prevailing over the hysteria of panic.

On the total municipal population, the incidence of small-pox was 0·2 per 1,000 against 0·5 in rural areas, a difference which must, in consideration of the more crowded state of the urban areas, be ascribed to the better conduct of vaccination within them. In no instance did the total number of cases in any town exceed 45, except in Madura where the number was 73. Madura, Dindigul, Cuddalore, Chidambaram, and Tanjore, were those which chiefly suffered.

Fevers.—The total deaths from fevers were 245,549, or at the rate of 7·3 per 1,000 of the total population. This is the smallest rate recorded since 1883. It unfortunately cannot be asssumed that this is due to any striking measures taken for the reduction of malaria. Quinine has been successfully issued at post offices, and there have not been wanting those who have hunted the *anopheles;** but no great measures that would effect removal of superfluous mosquitoes, or moisture that would encourage their existence, from large areas have yet been carried out. Rather must the reduction be regarded as due to the imperfect character of the north-east monsoon failing to bring with it the essential presence of moisture in the soil, and to the not insignificant influence of a desire on the part of those registering deaths to escape suspicion of a disease whose prominent symptom is fever, namely, plague. Although it is well known that the majority of these "fevers" are of malarial origin, doubtless phthisis, pneumonia, pleurisy, affections of the liver, and diseases generally where fever is the prominent symptom, are included under this rough head. Until more medical men of Western education can find it profitable to compete for private practice against hakims and vaithiyans, or all existing subordinate members of the Medical Service are utilized in some measure for supervision of registration results, it would be impossible to attempt to differentiate malaria and specific affections included under the widely general term "fevers." In the meantime, some effort is being made to secure a better approach to accuracy in municipalities. I have advised all municipalities as to the advantages that would accrue by causing their Registrars to undergo training at the hands of local medical officers, sufficient for them to understand the more prominent symptoms of common diseases, so that, where no medical certificate accompanies a declaration of death, it shall be possible to elicit from the person making it the probable nature of the disease.

There is no lack of instances in this Presidency where a locality in which mild fever has existed has been converted into a deadly malarious place, by introduction of superfluous water for irrigation puposes, and there are instances where limitation of irrigation has been followed with beneficial results, but none where extensive works of drainage have secured the admirable curative influence obtained in other countries. Hence, it was hoped that the proposal to introduce a sewerage system and sub-soil drainage in the notoriously malarious town of Cuddapah would have afforded an object lesson. Unfortunately, up to date, the whole question has been under intermittent consideration. It has at last been decided by the Sanitary Board to deal with one of the factors concerned in the obstruction to the sub-soil water-flow, namely, the Patha-Cuddapah tank. It was proposed that this should be completely breached. In lieu of this procedure, it has lately been suggested to cut a channel to tap the sub-soil water layer between the town and the tank. This will, in all probability, have considerable influence if properly conducted, but unfortunately it has been determined to make all further action depend upon results so acquired. As this mode but deals with one of the factors, it is improbable that any marked results will be secured, and thus will be lost an opportunity of demonstrating what can be effected in a malarious area by whole-hearted efforts.

* I have recently issued a circular calling the attention of Local bodies to the importance of concerting measures to circumvent the *anopheles* genus of mosquitoes.

During the year Major Grant, I.M.S., Professor of Hygiene, invited attention in his report as Assistant Physician, General Hospital, Madras, to the severe nature of malarious fevers found in Madras town. His opinion was combated by certain medical officers, who apparently would not even admit the malarious origin of Madras fevers. Unknown to Major Grant, I had drawn attention to the same facts in 1894, and in subsequent years, in reference to sub-soil water fluctuation in Madras. I relied not only upon the clinical symptoms, but upon the careful microscopical diagnosis made in indubitably Madras-bred cases by Lieutenant-Colonel Sturmer, I.M.S. Not only does malaria exist in Madras itself, but intense forms are to be found within seven miles of it at Ennore—a once favoured health resort in which disturbance of sub-soil and surface water was brought about by railway and canal configuration. In 1896 I spent several days here, and obtained ample microscopical evidence of the presence of the *plasmodium malariæ* in its various forms, in subjects who had indubitably acquired the disease locally. It must not, however, be considered that malaria is the sole cause of fever in Madras town. Typhoid fever is by no means uncommon. Phthisis and low forms of pneumonia are prevalent amongst the poorer classes. There are doubtless also hitherto unclassified fevers to be demonstrated by the observer of the future.

Dysentery and Diarrhœa.—The term "dysentery and diarrhœa" necessarily includes all catarrhal affections of the intestines; it is impossible to say to what extent true dysentery is really in evidence. The death-rate in the Presidency from this cause was the same as in the preceding year, namely, 0·9 per 1,000. The highest proportion of mortality for districts from this cause was, as usual (if the town of Madras be excluded), in Chingleput. It is presumed that, in addition to the usual causative agents of dysentery and diarrhœa, there exists in that district a favouring cause in the brackish water used by a considerable proportion of the population. December and January were the months that exhibited the greatest mortality under these heads.

The proportion of deaths from dysentery and diarrhœa in municipal towns greatly exceeds that reported in rural areas, the total average being 4·3 per 1,000 in the former against 0·7 per 1,000 in the latter case. The following shows in descending order the towns which have returned the largest mortality under this head:—Gudiyáttam (8·6), Nizianagram (8·4), Madras (7·9), Walajapet (7·7), Vizagapatam (7·6), Tuticorin (7·4), Chingleput (7·1), Coonoor (6·6), Máyavaram (6·1), Vániyambádi (5·9), Parlákimedi (5·7), Conjeeveram (5·5), Tiruvannámalai (5·3), and Periyakulam (5·2).

These are towns either where conservancy is defective, or in which the water-supply is open to contamination; frequently, these two defects are conjoined with a brackish condition of the water. Variations in the registered amount of dysentery and diarrhœa from year to year are brought about by the occurrence of cholera, when doubtless attempts are made to conceal the existence of this disease, or, more especially at the beginning and end of such epidemics, mistakes in diagnosis occur; but on the whole, from year to year, there is, broadly speaking, little material change of the death-rates from dysentery and diarrhœa in any special town. There is little tendency to epidemic outbreak. On the contrary, where bowel affections have established themselves, they seem to claim their victims at fairly regular rates from year to year, proving that permanent not passing sanitary defects are at work. For example, the following have been the rates in certain towns during the last five years:—

Towns.	1895.	1896.	1897.	1898.	1899.
Chingleput	...	...	4·4	6·8	7·1
Coonoor	3·9	7·9	7·2	6·3	6·6
Madras	4·9	5·3	4·5	7·5	7·9
Periyakulam	5·1	5·9	6·3	6·1	5·2
Tuticorin	6·3	6·1	4·0	9·3	7·4

Injuries.—The deaths from injuries in towns was in the same proportion as in rural areas, namely, 0·4 per 1,000. When the figure are calculated upon the estimated population, the rate is reduced to 0·3, which has for nine years past been the invariable resultant under this head. For every 100 females that died of injuries, there were 112·4 deaths in males under this head. For every 100 suicides by females, there were 82·2 by males. 2,036 deaths occurred from snakebite.

All other causes.—In districts, the proportion of deaths under "all other causes" was 10·1 per 1,000 against 18·4 in municipalities. It is possible that this increase in municipalities implies a certain amount of extra care in differentiating death causation.

Sanitary Works.

Municipalities.—As foreseen when writing my last Report, sanitary advance, as indicated by permanent engineering works capable of favourably influencing the health of municipal populations, has been greatly trammelled by the conditions of uncertainty attending plague prevalence. No public body knew whether its ordinary resources, and even its borrowing powers, would not be strained to the utmost on being called upon to repel attacks by plague. Hence the policy of Municipal Councils has been to retain a considerable balance in hand, which should be available to meet the exigencies of a plague epidemic. Consequently, in 1899, no sanitary engineering work of great importance was commenced. The water-supply system of Tirupati was completed in time for the great annual festival of the Brahma utchavam at Tirupati. Water-supply extensions in Tanjore and Conjeeveram were also completed during the year. The small results secured are necessarily very disappointing, but were inevitable. Even where for routine purposes allotments had been made, the general unwillingness to part with funds is exhibited in the small expenditure during the nine months of the official year. Thus, whilst in 1898 by the end of December, 53·8 per cent. of the total allotment had been spent, in 1899 it amounted to but 47·0 per cent. On the other hand, the total allotment was somewhat larger during 1899 than in 1898, this being £129,574 against £104,770.

The following statement shows the expenditure on sanitary improvements :—

	1898–99.			1899–1900.		
	Amount sanctioned.	Amount expended.	Rate per cent. of expenditure to total allotment.	Amount sanctioned.	Amount expended during the nine months ending December, 1899.	Rate per cent. of expenditure to total allotment.
	£	£		£	£	
For conservancy	47,216	45,310	95·9	57,694	32,652	56·6
For improvement of village or town sites.	16,723	14,862	88·8	16,127	11,633	72·1
For improvement of water-supply, cleansing, repairing, and construction of tanks and wells.	10,390	10,308	99·2	49,511	13,082	26·4
For sanitary arrangements during fairs and festivals.	970	937	96·6	2,104	504	23·9
For construction and repair of markets and slaughter-houses.	1,286	844	65·6	1,196	969	81·1
For other sanitary outlay ...	8,012	4,794	59·8	2,944	2,066	70·1
Total	84,597	77,055	91·08	129,576	60,906	47·0

In municipalities, the amount realized by the sale of night-soil and rubbish was £2,130. The utilization of night-soil by cultivators is undergoing an extension that must necessarily be gradual. For a certain period, caste prejudices stand in the way of night-soil being utilized even when presented in the form of inodorous poudrette. But, it is evident that when the ryot has an "object lesson" showing the excellent results on crops, these prejudices disappear. Hence, the price of night-soil in certain municipalities is undergoing from year to year increase. Curiously enough, when the ryot has really made up his mind to use night-soil, in certain localities, he insists upon having the raw material or nothing at all; he regards poudrette as a weakly manure. "Trenching" followed by the sowing of crops by the municipality concerned with the hope of affording ryots object lessons was conducted at Bellary, Erode, Anakápalle and Nagore. At Rajahmundry, splendid crops of Batavia oranges are raised in sandy soil that has been richly trenched. At Karúr, Rajahmundry, Tinnevelly and Negapatam sewage farming

was conducted with profit. At Kumbakónam, Bezwada, Vizagapatam, Vizianagram, biological purification (filtration) of sewage was employed so as to intercept crude sewage passing to unsuitable outlets, such as streams liable to be used for drinking water and tanks. At Guntúr and Vizagapatam, arrangements are in progress which will enable sewage farming to be conducted next year. At Tanjore, sewage farming continues under unsatisfactory conditions, that is, a large portion of the total amount available is allowed to flow to waste. The sanctioned scheme for its full utilization was in abeyance during the year, owing to the loan of Rs. 33,000 required by the municipality not being accepted in the open market. In Madras, farming with sewage continued to be financially successful; but the farms fail to use the total sewage diverted to them. I advised, in 1894, unsuccessfully, that this surplus sewage should be received on filter beds rather than be allowed to be discharged at undesirable points.

District Boards.—I have, in my successive Annual Reports, expressed the hope that each following year would see issued the revised District Boards Act that would enable the sanitary requirements of District Board areas to be considered more seriously than at present. But it has not yet been possible for Government to finally deal with this Act. It is, however, before a Committee at the present time. I trust the revised Act will give more power for sanitary administration, otherwise efforts towards advance must be slow in character and far from abiding. At the present time, the ambition of District Boards rises little above the maintenance of roads, and this they usually perform unsatisfactorily and therefore with bad economy.

Last year, the sanitary allotment for all District Boards under all heads amounted to the very poor contribution of 8·3 per cent. of their total income; in 1899, it decreased to 7·2 per cent. This implies an allotment per head of the population of 3·6 pies, or about one farthing in current exchange. The number of villages conserved fell from 444 to 256. Much of the economy effected in respect of these villages was due to the non-employment of sweepers who simply remove rubbish from the streets of the village, but, on account of caste prejudices, refuse to deal with fœcal matter. There can be no doubt that the collection of rubbish to the neglect of night-soil was incongruous, and employment of these men was in this sense not justifiable. But in no case have District Boards, in making these sweeping economies, endeavoured to replace the sweeper by the more useful scavenger, or to concentrate upon certain of the larger villages correctly organized staffs, so as to render both rubbish and night-soil conservancy effective. On the contrary, the change has been carried out solely with a view to economy. At the same time, it must be confessed that difficulty in obtaining a reserve for possible plague epidemic charges justified efforts as to economy, although sanitation seems to have fallen an easy prey. It can but be hoped that, with the advent of better times, District Boards will in the future again expand the number of conserved villages.

The following statement exhibits the expenditure on sanitation during the year :—

	1898-99.			1899-1900.		
	Amount sanctioned	Amount expended.	Rate per cent. of expenditure to total allotment.	Amount santioned.	Amount expended during the nine months ending December, 1899.	Rate per cent. of expenditure to total allotment.
	£	£		£	£	
For conservancy	23,228	20,504	88·3	22,533	17,260	76·6
For improvement of village or town sites.	4,718	2,854	60·0	4,309	2,764	64·1
For improvement of water-supply, cleansing, repairing, and construction of tanks and wells.	8,742	5,728	65·5	7,065	3,372	47·7
For sanitary arrangements during fairs and festivals.	1,120	902	80·5	1,301	630	48·4
For construction and repair of markets and slaughter-houses.	3,933	3,089	78·5	4,200	1,193	28·4
For other sanitary outlay	2,246	1,141	51·2	1,996	578	28·9
Total	43,987	34,218	77·8	41,404	25,797	62·3

Fifteen Certificated Sanitary Inspectors were permanently employed by District Boards for routine sanitary duty, being an increase of three over last year. Having regard to the fact that District Boards have charge of a united area of 124,914 square miles containing a population of 32,603,685, and collect yearly an income of *£524,826, it must be said that their efforts towards organizing efficient sanitary staffs are exceedingly feeble. In the majority of districts, the early recognition of epidemic diseases and their prompt eradication are not matters that receive much attention. It is recognized that when an epidemic becomes obtrusive, it is necessary to do something. This is usually confined to temporarily detaching a solitary Hospital Assistant for charge of an area larger than an English county, and expecting him to divide his attention successfully between preventive and curative medicine. At the very least, there should be permanently appointed for one taluk—usually representing an average of 762 square miles—a single Certificated Sanitary Inspector, and there cannot be the slightest doubt that this could be easily afforded by every District Board in the Presidency. It also seems to me that there are important functions that require fulfilment, and sufficient funds available to enable *Assistant* Certificated Sanitary Inspectors to be employed in many of the unions.

Personal Proceedings and General Remarks.

I returned on the 3rd January 1899 from inspecting the plague-infected localities in the Alúr and Gooty taluks, on which duty I had been engaged during December of the preceding year. On the 7th of the same month I proceeded to Bellary with the object of opening a class for Temporary Sanitary Inspectors. This was an urgent necessity, owing to the impossibility of keeping pace with the demand for Certificated Sanitary Inspectors. Bellary was selected as the centre for training, with the hope of securing a preponderance of Telugu-speaking candidates—the plague-infected tracts being at that time chiefly where Telugu is the vernacular. The endeavour was to train well-educated men so as to be capable of recognizing the disease, of taking necessary preliminary action, and of understanding the methods and reasons for disinfection. The course of theoretical and practical instruction and examination extended from the 9th to the 27th January. Sixty extra Sanitary Inspectors were thus rendered available to meet possible urgent demands. Whilst in Bellary, the measures undertaken by the municipality against invasion were carefully entered into—especially with reference to the danger of importation from Hospet. In company with the Collector, plague arrangements at Hospet were duly inspected. During February, I inspected the Railway Inspection plague camp at Jalarpet. As the disease had appeared in Vellore, I made a complete inspection of arrangements and advised thereon. From thence, I proceeded to Arcot, and ascertained and advised as to methods there being adopted against plague. This tour occupied ten days. On the 21st February I started for Tirupati. As a pilgrim centre it was imminently liable to infection, and, indeed, imported cases had already appeared. The town was inspected. The plague-infected villages of Walajah, Pinji, and Ránipéttai, were then examined in company with the officers locally responsible. This tour occupied from 21st February to 5th March. During April the town of Cuddapah was inspected more especially with reference to the condition of the water-supply. By this time, plague had markedly declined. During the remainder of April and May I remained at head-quarters for the teaching of practical hygiene to candidates for the post of Certificated Sanitary Inspectors, and subsequently, as Chairman of the Government Technical examinations in Sanitary Science, undertook my part in their examinations. This is no part of my official duties, but the period spent consorts well with the fact that it is desirable to remain at head-quarters for the compilation of the Annual Administration Report. On the 7th June I proceeded to Guntúr and inspected the site for the proposed water-works. From thence I went to Masulipatam and conducted an inspection of the town. The municipality of Rajahmundry and the Union of Amalapuram were then inspected. In these places, which are notorious for beri-beri, the question of the existence of the disease amongst the populations was entered into, and numerous cases were examined clinically and microscopically. I returned to head-quarters on the 6th July. On the 18th July, I proceeded to Kurnool to undertake inspection of that town. With reference to the sanitary protection of the water-supply of this place, it was also necessary for me to examine certain villages along

* This is the actual annual average of the receipts for the five years ending 1898-99.

the Kurnool-Cuddapah canal. I returned to head-quarters on the 6th of August. On the 9th of August I was required to meet the Sanitary Board, which was convened to discuss on the spot the water-supply scheme of Coonoor. I took the opportunity of making an inspection of the town. In response to a request by the Ootacamund Municipality, I consulted with its Committee as to the proposed drainage scheme. The opportunity was also taken of inspecting Ootacamund, and special care was exercised in attempting to ascertain the ordinary methods of spread of typhoid fever in that health-resort. I remained at head-quarters till the 3rd of October. On the 5th October I journeyed to Vizianagram, where the District Medical and Sanitary Officer (Captain Giffard, I.M.S.) had reported an interesting outbreak of beri-beri amongst the Native Infantry. A number of cases were examined by me with the aid of the District Medical and Sanitary Officer and the officer in charge of the Regiment. The Municipal town of Vizianagram was now inspected. I returned to Madras on the 13th October. I then proceeded to Tiruvannámalai, with special reference to the then approaching great annual festival. I returned to Madras on the 20th October. From the 4th to 27th November I was absent from head-quarters, and during this period I inspected Trichinopoly, Srírangam, Madura, and Tanjore. Dindigul was visited with special reference to the water-supply scheme. I again left Madras on the 9th December with the intention of making a tour throughout the West Coast municipalities. I arrived at Calicut and inspected a portion of the town on the 10th. On the 11th I received a telegram reporting an alarming outbreak of plague at Tiruppattúr in the Salem district. I at once proceeded there, and, having consulted with the Collector, returned to Calicut on the 15th. I was on that date attacked with an illness that incapacitated me from conducting any further out-door work, although my office work continued to received my full attention. Written reports of the above inspections were forwarded in each case to the authorities concerned and to Government. During the year, a distance of 6,749 miles was travelled by road, rail, and canal.

The total attacks of plague in the Presidency for the whole year amounted to 2,385 followed by 1,843 deaths. By the middle of May, the plague epidemic which had commenced in the last quarter of the previous year in the Deccan districts of Anantapur, Bellary and Kurnool showed marked symptoms of diminution in March, and had completely disappeared within the first three weeks of May. In these districts there had occurred a total of 70 imported and 716 indigenous cases followed by 56 and 588 deaths, respectively. In the North Arcot district plague lingered up to a later date; indigenous cases did not cease till the end of June. In this district there were 67 imported and 647 indigenous cases, followed by 55 and 501 deaths, respectively. In the Hosúr taluk of the Salem district, however, although from May to June there was exhibited a decrease of indigenous cases, plague manifested a continued, though not severe, prevalence throughout the year. In December a second taluk in the Salem district was attacked. This followed a severe outbreak in the municipal town of Tiruppattúr, owing to a lamentable want of discretion by the municipal authorities. The total imported cases in this district were 141 and indigenous cases 682, followed by 88 and 508 deaths, respectively. Kollegal taluk of Coimbatore was subjected to a short epidemic outbreak extending from October 7th to December 16th. In this district there were 1 imported and 47 indigenous cases, followed by 37 deaths. Imported cases were also reported in Chingleput, Nilgiris, Trichinopoly, Nellore and Madras town. In none of these instances was importation followed by indigenous plague.

Having regard to the usual behavour of plague, as reported by various authorities, affecting recrudescence of the disease in villages where it had appeared in its indigenous form, it was felt the chances were considerable that, either following the moisture incident to the south-west monsoon, the decreased incidence shown in April and May would give way to fresh outbreaks, or that at least on the expiration of a year, which would repeat the same meteorological influences under which it had flourished, a recurrence would take place. I am glad to say, however, that so far in this Presidency not a single instance has been recorded of what would be correctly understood as recrudescence. Indeed, were it not for the continued presence of plague in the Hosúr taluk of the Salem district—a condition that may well be ascribed to the free intercourse which exists with the neighbouring infected Mysorean villages—it might be said that villages that have been once affected have escaped fully any recurrence. The deduction might be drawn that sources of infection had been so carefully sought for and destroyed that no recrudescence was possible. It seems to me, however, that the chances are that when it is implied by recrudescence that the disease had completely disappeared from human beings and that

the germ, with decreased vitality, but awaited favouring conditions in some suitable medium for a return to virulence and spread to human beings, there is assumed more than were it be held that it was due to the continued propagation of the disease by its slight and, therefore, unrecognized existence amongst the population.

It cannot be said that additional information as to transmission of plague has been gained. The opportunities for observation have been chiefly in the hands of non-professional persons, owing to the peculiar constitution of plague staffs incident to the policy pursued throughout India. Where medical men have been employed, it is rarely they have had sufficient time at their disposal to correctly elucidate occurrences. In my last year's report, I held that the great importer of plague was the human being, and that, subsequently, in the affected areas its spread was facilitated by rats, and particularly drew attention to the absence of evidence implicating inanimate articles imported from a plague-infected area as the original cause of plague in a hitherto unaffected locality. The experience of both lay and medical officers in the Hosúr taluk of the Salem district, however, dictates that not only rats but grain infected by them is an important mode of spread. Indeed, the District Medical and Sanitary Officer considers infection by mouth by medium of infected food to be indubitably the chief mode of spread. Unfortunately, the evidence which he brings forward, although giving colour to his assertion, does not seem to be of a nature that could be accepted with the certainty necessary in dealing with so important a statement. It is, however, necessary to collect all facts bearing on the question of mode of transmission with care, and with the object of inducing officers to collect further data, I draw attention to this officer's opinion. With a hope that in each district invaded it would be possible gradually to collect a store of facts that would illustrate the truth in such matters, the Plague Commissioner under my advice, in his Proceedings No. 951, dated 12th April, 1899, required that 'Collectors of Districts should maintain a special record in diary form, to which all persons under their orders dealing with plague should be requested to contribute facts coming under their own observation of a sanitary nature. Unfortunately, no Collector has maintained the record suggested.

There was no change of policy with which Government met the requirements of plague administration during the year. The method of detection trusted to has been that of inspecting travellers by road, rail and sea on routes communicating with infected areas, isolation of the sick, and requiring the healthy during the periods of possible incubation to be subject to surveillance whilst in no way restricting their movements. The District Board, municipal and village organizations lend themselves to the successful effecting of this scheme. In one respect a flaw existed in the arrangements, in that it was possible for persons from affected villages to scatter hither and thither before coming under the influence of the passport regulations. Hence a new regulation was required. It has been arranged that *before* starting from an infected village the inhabitant should obtain a passport which, under the usual rules, will secure his surveillance whilst travelling beyond its limits. It is also required that inhabitants of an infected village proceeding to camp in its neighbourhood should receive the approval of the plague officer of the site selected by them, in token of which "passes" were to be issued. A system which demands that at certain points an uneducated native should be given a piece of paper, by which it is required he should present himself for a period of ten days to the Plague authority at any village or town at which he may halt, may seem well-nigh visionary; yet, experience shows that, under this simple method, the free population can be allowed to pass from one end of the Presidency to the other, with fair assurance that both the passport bearer and the local officer responsible for the examination of his health will fulfil their duties. By means of this system, a large number of the imported cases have been detected at the very onset of the disease, and thus the possibility of spread has been enormously minimized. Of course, it has not been possible to ensure that all passport-holders should have been put under surveillance; still, the amount of success which has attended the endeavour suffices to prove its great utility—more especially when contrasted with the inconvenience and indifferent results brought about in at least one other Presidency, by the adoption for a considerable period of the principle of "detention camps"—land quarantine. In my last year's report, I quoted the percentages of failure to trace the passport-holders as ascertained in the districts. As I have no doubt vigilance has not been relaxed I have not thought it necessary to put Collectors to the trouble of furnishing me again with statistics. A fair example, however, of what can be done, even in large towns, is illustrated by results obtained in the Municipality of Madras where, failure to trace passport holders occurred only in 3·4 per cent. of 55,407 cases. Discipline, therefore, in a free population cannot be

absolutely complete, and it must be admitted that introduction of plague is possible by cases that have eluded surveillance; yet, the figures are so enormously in favour of successful surveillance that no one can feel otherwise than that the system is of distinct practical value.

In towns, much passive opposition to evacuation of infected houses has been exhibited; but, in rural areas, the benefit of rapid evacuation is often so well recognised that on the occurrence of plague there is a general exodus to encampments on clean sites outside the town. Lieutenant-Colonel Lawrie, I.M.S., having adversely criticised the bacterial purity of haffkinine before the Plague Commission, the educated native public lost faith in anti-plague inoculation. As a result only 5,955 persons were inoculated during the year. It will take some time before the prejudice thus caused can be eradicated.

The use of Chinese pumps was found in practice arduous to the men employed; hence, I designed a so-called "gravitation disinfector," which has been favourably reported upon by medical officers who have seen it in use. This consists of a twenty-four-gallon bucket mounted on a platform on wheels fitted with guiding rods, which permit of the bucket being elevated to a height of 20 feet. To the bucket is attached a canvas hose pipe 120 feet long having a suitable spray at the end. Two men can transport and place the machine in a position outside the house to be disinfected. A powerful spray of about 18 feet in height can then be secured, and be conducted to any part of the interior with ease. With the aid of Mr. Phipps, of the Madras Railway Company, in carrying the idea into practice, I also initiated a disinfecting machine that would apply a hot gas blast to any part of indestructible floors and walls—much on the principle of the painter's lamp. On comparing bacteriologically results of disinfection of floors by this machine with those secured by other observers with the acid solution of the perchloride of mercury, I came to the conclusion that, so far as superficial layers of earth are concerned, the use of heat presents no advantage over that of the disinfectant named, whilst the consumption of time in securing the necessary temperature in so badly conducting a medium as earth, inevitably charged with more or less moisture, was to its disadvantage, unless it be proved that the plague microbe could exist at greater depths than readily reached by soakage of a fluid disinfectant, say, one-sixth of an inch—as to which, Yersin notwithstanding, information is incomplete.

I have already stated the area of the Presidency examined by me with reference to beri-beri. This interesting work I undertook more especially with the object of ascertaining how far it is possible to accept the contention by Captain Fearnside, I.M.S., in a pamphlet which was communicated to a professional journal and to the Government of India, that the symptoms usually recognized in this Presidency as beri-beri are due to a malignant infective form of the *plasmodium malariae*. I made no further advance than dozens of observers better fitted for the task in ascertaining what is precisely the nature of the specific germ of beri-beri, but of this I feel absolutely convinced, after examining microscopically the blood of a large number of cases, that the disease known as beri-beri in the Madras Presidency is not due to the presence of the *plasmodium malariae*. That beri-beri and malarial cachexia may co-exist there can, of course, be not the slighest doubt; and, when they do co-exist, the condition of the patient is greatly aggravated. But this is a very different matter to malaria being regarded as the *fons et origo* of the disease.

Members of public bodies are rarely open to conviction as to contamination of the sub-soil in connection with water-supplies. The great distances from possible sources of contamination and the actual points of withdrawal of water-supplies tend to make them believe in safety from any form of contamination, when guarded by the well-known purifying influence of filtration through the sub-soil. To be able to easily demonstrate to unbelievers the source of contamination is important. The use of common salt or salts of lithium renders necessary a preliminary as well as subsequent analysis of water, involving expenditure of time and trouble. Hence, it is worth while placing on record how readily a demonstration is procurable by utilizing "fluorescence." In an experiment conducted by me at the Cuddapah water-works, it was easily proved that when the line of saturation in the infiltration bed was lowered by pumping, there occurred an inrush of possibly contaminated water from a neighbouring road ditch, and, further, that contamination so acquired passed through the sub-soil so as to reach wells 303 yards distant. When it is remembered that this is a mere visual test, its advantages over older methods are obvious. It has been employed in America for the purpose indicated for some time past.

I have already referred (page 162) to the increasing interest which is taken in the subject of sewage filtration. The principles followed by me were such as advocated by the Massachusetts State Board of Health. These, in my opinion, serve admirably when applied

to designs of filters where supervision is likely to be of the smallest. At any rate, these principles suffice for what I term "makeshift filters," that is, filters devoid of valves and other arrangements which would be necessary adjuncts of Dibdin's mode. A clay lined earthen reservoir with sand, washed gravel, and road metal under-drained by tile drains offer cheap and efficient media.

When such filters are worked intermittently so as to secure aeration, I think it will be rarely that any more elaborate modes need be adopted in this country. The utility of the "septic tank" is a matter which has apparently "caught on" to the mind of the educated public of India. Very little consideration will, however, show that the reasons for the success of this and of Dibdin's method in Great Britain depend upon conditions that are not likely to occur frequently in India. The bugbear of a Municipal body in disposing of its sewage in England is the great cost of land, prohibiting disposal of sludge and fluid sewage. In India, however, it can be but rarely that the municipality need fear the cost of land for what is proved to be in Madras, at least, the profitable investment of sewage farming. Where a town has a correctly designed system of sewerage, then I hold that usually disposal by sewage farming, or highly under-drained beds will prove ample for requirements in India, and I foresee that the great utility of sewage filtration is where but imperfect systems of sewerage exist. Judiciously placed sewage filters will then prove of the utmost value in preventing reckless contamination of water sources. Similarly, in the absence of sewerage systems, filtration of sewage at the household—permitting the filtrate to flow on the surface—will prove an infinitely safer method than consigning it to the sub-soil by medium of leaky cesspools. Both public and private sewage filters have been in use since 1895 in this Presidency.

Since 1891, when I was placed on "special duty" by the Madras Government with reference to ascertaining the best mode of supplying preserved animal lymph, I have from time to time urged the importance of this Presidency possessing a Central Vaccine Institute, where animal lymph should undergo cultivation and preservation under conditions that would guarantee the requisite absolute cleanliness and high grade of activity. I have also advocated the advisability of uniting a bacteriological laboratory with this Institute, with the object of placing at the disposal of the bacteriologist the splendid opportunities of studying serum therapeutics, which the possession of a large number of animals and facilities for their handling and care would afford. It is with no small pleasure, therefore, that I find myself able to record that Government has now consented to the establishment of such an institute.

Sanitary Engineering.

The extension of the water-works at Conjeeveram, which was in progress in 1898, was completed in the year under review, as also the extension of the pipe lines in Tanjore. These two works were carried out under the supervision of the Sanitary Engineer. The scheme for the water-supply of Tirupati at an estimated cost of £15,400, which was undertaken by the Public Works Department, was also completed during the year.

Three municipal towns were surveyed in connection with water-supply, and two drainage and seven water-supply schemes were prepared and submitted either to the Sanitary Board or to Government. The schemes for the water-supply of Tuticorin and Coonoor, and for the extension of the water-works at Trichinopoly and Cuddapah, were sanctioned by Government—the first two for execution by the Public Works Department and the remainder by the Sanitary Engineer. A scheme for the extension of the pipe lines in Kurnool was also sanctioned during the year, but the execution of the work was not insisted upon, owing to the crippled state of the finances of the municipality. The Inspector of Steam-boilers and Prime-movers visited the pumping stations of the water-works at Kurnool, Conjeeveram, Cuddapah, Madura, Trichinopoly, Tanjore and Dindigul, and reported on the engines, boilers and pumps. The condition of the pumping plants is stated to have much improved since their examination by this officer in 1897. The Sanitary Engineer prepared six type designs for sanitary works and gave advice to the Sanitary Board in 57 cases.

Sanitary Board.—The constitution of the Sanitary Board continued to be the same as in the previous year; but the rules for the conduct of its business were slightly modified

so as to permit a local board or municipal council or other authority to apply to Government for orders in the proper department when it objects for financial or other reasons to adopt a design or an estimate prescribed by the Sanitary Board. The Board scrutinised plans and estimates for one Provincial, 34 Municipal and 79 Local Fund works of the estimated cost of £128,876. These comprised schemes for the water-supply of Tuticorin, Guntúr, Periyakulam and Bezwada, for the extension of the water-works at Trichinopoly and for the drainage of the Ootacamund bazaar, which were examined and laid before Government. Proposals for 17 other schemes were also considered by the Board, although estimates for them had not been prepared. Six new type designs were approved for issue, but as many of the designs already issued have been found too expensive for the minor local bodies, the Board has taken steps for the preparation of cheaper designs.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1899.

(*Lieutenant-Colonel J. W. Clarkson, I.M.S.*)

General Population.

European and Eurasian Vital Statistics.

The European civil census population of 1891 in the Bombay Presidency, exclusive of cantonments in quasi-foreign territory, is 18,486. During the year 1899, 221 births and 231 deaths were recorded against 246 and 243 in 1898—a birth-rate of 11·96 per 1,000 against 13·31 in 1898 and a death-rate of 12·52 against 13·14. By sexes 116 males and 105 females were born against 141 and 105 in 1898, and, as regards deaths, 145 males and 86 females died against 145 and 98 in 1898.

The Eurasian census population of 1891 is 8,519. During the year 1899 the births amounted to 166 against 123 in 1898 and the deaths to 185 against 169, the rates being 19·49 per 1,000 against 14·44 in 1898 and 21·72 against 19·84. Of those born, 82 were males and 84 females against 64 and 59 in 1898; as regards deaths, 95 males and 90 females died against 93 and 76 in 1898.

The causes from which deaths among Europeans and Eurasians were recorded are given in the following table:—

Causes of deaths.		Europeans.				Eurasians.			
		1899.		1898.		1899.		1898.	
		Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.
Bombay Presidency.	Cholera	2	·11	—	—	—	—	—	—
	Small-pox... ...	—	—	—	—	1	0·12	—	—
	Plague	16	·87	14	·76	32	3·76	23	2·70
	Fevers	27	1·46	25	1·35	16	1·88	21	2·46
	Dysentery and Diarrhœa.	26	1·41	26	1·41	21	2·46	13	1·53
	Injuries	8	·43	10	·54	8	·94	5	·59
	Other causes ...	152	8·24	168	9·08	107	12·56	107	12·56
	All Causes ...	231	12·52	243	13·14	185	21·72	169	19·84
Cantonments in quasi-foreign territory.	Fevers	—	—	2	*	—	—	1	*
	Other Causes ...	3	*	2	*	—	—	2	*
	Total ...	3	*	4	*	—	—	3	*

* As the population for the cantonments in quasi-foreign territory is not obtainable, the ratio of deaths cannot be worked out.

Two deaths from cholera among Europeans were recorded during the year 1899, of which one took place at Dhárwár and one at Ahmedabad. In 1898 no deaths from this disease were recorded among Europeans. Among Eurasians no deaths from cholera were recorded in 1899. From small-pox there was only one death in the City of Bombay and that occurred in an Eurasian.

In the City of Bombay during the year 1899 there were among Europeans 12 deaths recorded from plague against 13 in 1898. In the collectorate of Poona and Dhárwár

there were among Europeans three and one deaths, respectively, due to plague. Among Eurasians there were 32 deaths recorded from plague, of which 29 took place in the City of Bombay, one in the collectorate of Ahmednagar and two in Poona. In 1898 there were 23 deaths recorded, 22 in the City of Bombay and one in the collectorate of Poona.

Native Population— Vital Statistics.

Births.—In the Presidency of Bombay, including Sind, during the year 1899, there were 685,348 births registered against 582,371 in 1898. The recorded births for the year under report were more by 102,977 than the number registered in the previous year, and also more by 37,574 than the decennial mean ending 1898. By sexes there were 355,869 males and 329,479 females against 302,635 and 279,736 in 1898.

The following table shows the number of births registered in each year from 1889 to 1899, their ratios per 1,000, and the proportion of males to females :—

Years.	Population.	Number of Births registered.			Ratio per 1,000 of Population.			In every 100 Births there were		For every 100 Male Births the Females were
		Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	
1889	16,454,414	312,974	287,515	900,486	19·02	17·47	36·49	52·12	47·88	91·87
1890	16,454,414	333,698	307,417	641,115	20·28	18·68	38·97	52·05	47·95	92·14
1891	18,820,346	354,630	328,047	682,677	18·84	17·43	36·27	51·95	48·05	92·50
1892	18,820,346	337,150	313,517	650,667	17·91	16·66	34·57	51·82	48·18	92·99
1893	18,820,346	345,424	318,881	664,305	18·35	16·94	35·30	52·00	48·00	92·32
1894	18,820,346	342,911	317,357	660,268	18·22	16·86	35·08	51·94	48·06	92·55
1895	18,820,346	350,115	324,189	674,304	18·60	17·23	35·83	51·92	48·08	92·59
1896	18,820,346	359,097	332,750	691,847	19·08	17·68	36·76	51·90	48·10	92·66
1897	18,820,346	327,573	302,120	629,693	17·41	16·05	33·46	52·02	47·98	92·23
1898	18,820,346	302,635	279,736	582,371	16·08	14·86	30·94	51·97	48·03	92·43
Mean for 10 yrs.	18,547,160	336,621	311,153	647,774	18·35	16·96	35·31	51·97	48·03	92·43
1899	18,820,346	355,869	329,479	685,348	18·91	17·51	36·42	51·93	48·07	92·58

The recorded birth-rate for the year was 36·42 per 1,000 against 30·94 in 1898, and a decennial mean of 35·31.

The number of births recorded was higher than that in the previous year in all the five registration districts.

Of the 24 collectorates and districts the number of recorded births in 1899 was higher than in 1898 in all the collectorates except the City of Bombay, Panch Mahâls and the district of Thar and Párkar. The City of Bombay, as usual, recorded a low birth-rate, 12·88 per 1,000, against 13·08 and a decennial mean of 17·67, and it was owing to plague. As regards the low birth-rate in the district of Thar and Párkar the Deputy Sanitary Commissioner, Sind Registration District, remarks that owing to famine in this district and consequent emigration of the people into other parts of Sind, the birth-rate for the year for the district of Thar and Párkar was lower in 1899 than in 1898 and the decennial mean.

The recorded birth-rates among the urban and rural populations of the Presidency were 26·48 and 37·80 against 24·05 and 31·91 in 1898. Except in the collectorates of

Ratnágiri, Kánara, Kaira, and throughout Sind, with the exception of Upper Sind Frontier, the birth-rates were higher among the rural than in the urban population. The urban rates were in many places greatly affected by the exodus caused by plague.

Out of 56 towns in the Presidency, 21 had a birth-rate exceeding 40 per 1,000. Poona, Belgaum, Bombay, Alibag, Ahmednagar, Dhárwár and Panvel have very low birth-rates. This, in the case of Poona, Belgaum and Bombay is chiefly due to the decrease in population owing to the exodus caused by plague.

Deaths.—Among the civil population in the rural, town, and cantonment circles in the Presidency, 672,269 deaths were registered during the year 1899. In 1898, 548,825 deaths, or 123,444 less than in 1899, were recorded.

The following statement shows the number of deaths recorded in each year since 1889 :—

1889	...	518,562	1893	...	511,831	1897	...	749,916
1890	...	463,616	1894	...	607,179	1898	...	548,825
1891	...	513,132	1895	...	538,540	1899	...	672,269
1892	...	611,742	1896	...	596,472			

Of the total deaths registered, 355,241 occurred among males and 317,019 among females (the sexes of 9 deaths in Sind could not be ascertained), against 288,796 and 260,029 respectively, in 1898. The death-rate per 1,000 in 1899 was 35·72 against 29·16 in 1898 and a decennial mean of 30·85. The millesimal rates of males dying to males living was 36·48 , and of females dying to females living was 34·90. In 1898 these ratios were, respectively, 29·66 and 28·63. For every 100 females who died, 112·06 deaths among males were recorded, but these proportions vary considerably in the following collectorates and districts :—

In Khándesh the ratio of male to female deaths was			113·15 per cent.
„ Thána	do.	do.	114·81 „
„ the City of Bombay	do.	do.	144·18 „
„ Kaira	do.	do.	114·48 „
„ Karáchi	do.	do.	125·11 „
„ Hyderabad	do.	do.	125·27 „
„ Thar and Párkar	do.	do.	129·24 „
„ Upper Sind Frontier	do.	do.	121·02 „

The highest death-rate occurred in the Western Registration District (45·57), which had suffered to a considerable extent from plague ; the lowest death-rate was in Sind (19·59). The death-rates in 1899 were higher than the decennial mean in all the registration districts except Sind.

The Deputy Sanitary Commissioner, Gujarát Registration District, remarks that "notwithstanding the ravages of plague, more or less severe throughout Gujárát during the past three years, and the effects of famine, which began to be appreciable during the last three months of the year, the general survey of births and deaths presents a satisfactory record." He further adds that "there is an almost complete absence of the usual scourges, small-pox and cholera, while the death-rate, in spite of plague and famine, is only slightly above the average of the past ten years.

The recorded death-rate per 1,000 in 1899 was higher than in 1898 in all the collectorates and districts except the collectorates of Dhárwár, Shikárpur and the district of Upper Sind Frontier. The Upper Sind Frontier was free from plague and scarcity. The high mortality in the City of Bombay and in the collectorates of Ahmednagar, Poona, Sholápur, Sátára, Belgaum and Dhárwár was due to plague.

The Deputy Sanitary Commissioner, Central Registration District, states that "there was practically no cholera and the deaths from small-pox were low, but there was a very heavy mortality from plague, and this accounts for the high death-rate during the year."

The Deputy Sanitary Commissioner, Southern Registration District, remarks that amongst the cause of deaths, fever and plague form the largest items in the Belgaum and Dhárwár Collectorates.

Deaths by sexes.—In the City of Bombay and the Upper Sind Frontier, the recorded death-rates of females were higher than those among males. In Sátára, Karáchi and Shikápur, the death-rates of males and females were about equal. In the remaining collectorates the death-rates of males exceeded those of females. In 1898 the female death-rates exceeded those among males in the City of Bombay, Broach, Kaira, Panch Maháls, Thar and Párkar and Shikápur.

Deaths by ages.—The figures given below show the total deaths in 1899 under different ages, as also the ratios per 1,000 living, calculated on the population of each age-period enumerated at the Census of 1891 and the percentage of total deaths :—

Age-period.	Population according to Census of 1891.	Number of deaths.	Ratio per 1,000 of population.	Percentage on total deaths.
Under 1 year	680,472	134,036	196·97	19·94
1 and under 5 years	2,178,646	104,459	47·95	15·54
5 and under 10 do.	2,615,588	38,030	14·54	5·66
10 do. 15 do.	1,820,754	28,373	15·58	4·22
15 do. 20 do.	1,470,976	23,697	16·11	3·52
20 do. 30 do.	3,410,817	66,488	19·49	9·89
30 do. 40 do.	2,765,949	67,400	24·38	10·03
40 do. 50 do.	1,841,976	56,032	30·42	8·33
50 do. 60 do.	1,117,120	52,013	46·56	7·74
60 and upwards	918,048	101,741	110·82	15·13
Total	18,820,346	672,269	35·72	100·

As compared with last year, the table shows that there has, in the present year, been an increase in the percentage of deaths under 5 years, and a decrease between 20 and 60. The Deputy Sanitary Commissioner, Sind Registration District, remarks that "owing to the famine people have been selling their cows during the last 2 months of the year, lots of deaths have taken place from convulsions on account of bad feeding."

Deaths by causes.—The subjoined table shows the deaths in 1899 arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1898, and with the decennial mean. The "causes of death" will be briefly noticed in the next section :—

Causes of deaths.	Mean for 10 years, 1889–1898.		1898.		1899.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	25,459	1·39	4,368	·23	8,579	·46
Small-pox	3,540	·19	1,834	·10	1,946	·10
Plague	Not available.		86,191	4·58	96,596	5·13
Fevers	384,517	20·96	216,324	11·49	228,438	12·14
Dysentery and diarrhœa ...	43,918	2·39	56,789	3·02	74,736	3·97
Injuries	6,155	·34	6,984	·37	7,102	·38
Other causes	102,393	5·58	176,335	9·37	254,872	13·54
All causes	565,982	30·85	548,825	29·16	672,269	35·72

The year 1899 was very unhealthy as compared with the previous year. The death-rate in the latter part of the year commencing from August to the end of the year was increased by the effects of plague and scarcity.

The recorded death-rates among the urban and rural populations of the Presidency were, respectively, 64·10 and 31·76 per 1,000 of population against 47·88 and 26·55 in 1898. Among the rural population the death-rate was higher than in the urban population in the collectorate of Kánara, where the rural death-rate exceeded the urban by 10·20.

Chief Diseases.

Cholera.—During 1899 cholera caused 8,579 deaths throughout the Presidency or 4,211 more than in the preceding year. The epidemic was most prevalent in the Belgaum, Karáchi and Dhárwár Collectorates, where 4,474 or 4·42, 2,394 or 4·27 and 1,335 or 1·27 deaths per 1,000 of population, respectively, took place ; whilst the minimum mortality occurred in the Ahmednagar and Sholápur Collectorates, in which there is only 1 death registered.

In December 1898 cholera deaths were reported from the collectorates of Belgaum and Dhárwár and the City of Bombay. In January of the year under report the disease was present only in the Belgaum Collectorate and in the City of Bombay, causing 10 deaths

in the former and 13 in the latter. In February 548 deaths were returned from 3 collectorates, namely, Belgaum, Dhárwár and Kánara and the City of Bombay. In March, however; in addition to the above, the collectorate of Karáchi was affected and 1,568 deaths were registered. In April the disease increased and caused 1,980 deaths. In May the disease had spread to 7 out of the 24 collectorates in the Presidency and 2,199 deaths were reported from them, the maximum for the year. In June and July the disease was prevailing in 6 collectorates and 1,389 deaths were reported. In August, September and October there was a decrease, 811 deaths having been reported. In November there were 33 deaths from this disease in 2 collectorates, and in December only 28 deaths.

In the Belgaum Collectorate the death-rate attained the high ratio of 4·42 per 1,000 of population. In the Karáchi Collectorate there was also a high ratio, namely, 4·27 per 1,000, whilst in the remaining collectorates the epidemic did not show high ratios.

By seasons 1,916 deaths out of 8,579 were recorded in the rainy season of 122 days.

Out of 220 rural circles or tálukas, 26 were affected by cholera, and out of 56 town circles, 12 were affected during the year. The affected area included 461 out of 25,143 villages in the Presidency. The highest percentage took place in Belgaum, where 259 villages out of 1,076, or 24·07 per cent., were affected. In Karáchi and Dhárwár Collectorates the percentages were 10·23 and 7·83 respectively.

Small-pox.—There were 1,946 deaths from small-pox (995 males and 951 females) against 1,834 in 1898, and a decennial mean of 3,540. The number of deaths during the year, though higher by 112 than the preceding year, was the lowest record with two exceptions during the last 12 years. The Western Registration District was the most affected, after it came the Southern and Central Registration Districts, Sind was very slightly affected, and the Gujarát Registration District gave only nine deaths. The ratio per 1,000 was 0·10, against 0·10 in 1898, and 0·19 the decennial mean. These figures may be considered very satisfactory, and they testify to the exceedingly good vaccination work which now for some years has been done in the Presidency. As regards collectorates, there was an increase in Thána, Bombay and Kolába in the Western, Ratnágiri in the Central, Bijápur in the Southern, Panch Maháls in Gujarát and Karáchi in Sind Registration Districts. The highest death-rate (0·56) occurred in Thána, and the lowest (0·01) in Belgaum and Shikárpur. The death-rates, 0·54 per 1,000 in the City of Bombay, and 0·46 in the collectorate of Kolába were much higher during the year 1899 than in 1898, 0·07 and nil, respectively. There was only one death from small-pox in the Hyderabad Collectorate, whilst in the collectorates of Surat, Broach, Kaira, Ahmedabad, and in the districts of Thar and Párkar and Upper Sind Frontier no deaths from small-pox were recorded.

According to age 28·37 per cent. of the small-pox deaths occurred amongst infants under one year of age, whilst 45·73 per cent. took place among children one to ten years, the remaining 25·90 being among persons over ten years of age.

Fever.—There were 228,438 deaths registered under the heading "Fever" (120,540 males and 107,898 females) against 216,324 in 1898, thus there was an increase of 12,114 deaths as compared with the previous year; the decennial mean is 384,517 which includes the deaths from plague for the past three years. The death-rate was 12·14 per 1,000 compared with 11·49 for the previous year and a decennial mean of 20·96, and this includes the deaths from plague during the years from 1896 to 1898. The death-rates in the Western and Central Registration Districts were higher during the year than that for 1898. In Sind the death-rate was nearly the same as that for 1898, and in the remaining districts it is lower than the previous year. In the collectorates of Khándesh, Násik, Thána, City of Bombay, Kolába, Ahmednagar, Poona, Sholápur, Surat, Ahmedabad, Hyderabad and the district of Thar and Párkar, there was an increase of ratios during the year over 1898. The collectorate of Broach heads the list with a very high ratio, 24·57 per 1,000, against 26·84 in 1898, and 32·53 in the previous ten-year mean. In the collectorates of Panch Maháls and Ahmedabad and in the districts of Thar and Párkar high ratios are observed, 21·44, 21·75 and 22·41 per 1,000, respectively.

Plague.—At the end of 1896 there had been a total of 2,909 attacks and 2,086 deaths deaths from plague, 61,093 attacks and 46,944 deaths were recorded during 1897, 110,369 attacks and 86,191 deaths were recorded during 1898, and 126,287 attacks and 96,596 deaths in 1899; the table below gives the progress of the disease by months in each collectorate for the year under report. The epidemic continued throughout the year, and was at its lowest intensity in June and reached its maximum in September. Only one district, Thar and Párkar, remained uninfected throughout the year.

No.	District.	January.		February.		March.		April.		May		June.		July.		August.		September.		October.		November.		December.		Total.		Number of Towns and Villages affected by Plague.
		Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	
1	Khándesh	198	162	184	142	199	154	35	28	1	1	2	2	—	—	110	79	48	47	5	5	—	—	—	—	782	620	22
2	Násik	155	128	324	269	338	281	151	127	74	61	155	130	991	768	2,545	1,911	3,875	2,976	1,980	1,608	176	155	27	27	10,791	8,441	154
3	Thána	585	499	803	677	1,063	970	595	503	288	279	149	114	361	281	488	383	226	226	183	175	103	103	152	152	4,996	4,362	146
4	City of Bombay	1,879	1,591	3,476	3,118	5,723	4,758	3,007	2,315	1,204	1,008	254	228	311	261	443	348	438	368	619	449	642	436	1,458	994	19,454	15,874	1
5	Kolába..	164	135	186	154	198	166	246	200	149	146	9	6	5	5	26	19	1	1	9	5	25	22	52	43	1,070	902	80
6	Ahmednagar..	53	22	38	23	25	20	9	6	11	3	12	5	73	20	498	373	1,746	1,173	1,119	839	256	146	76	51	3,920	2,681	93
7	Poona	129	80	178	115	488	389	394	314	335	276	479	377	3,546	2,722	7,422	5,947	6,996	4,839	4,166	2,873	882	882	233	233	25,239	19,047	262
8	Sholápur	115	57	61	27	55	42	13	12	27	20	3	3	11	3	148	63	229	80	427	289	557	476	871	695	2,507	1,767	59
9	Sátára	892	622	565	462	458	302	227	130	180	125	264	196	873	636	1,312	929	2,928	2,085	3,377	2,358	868	688	231	207	12,175	8,740	298
10	Ratnágiri	7	3	24	22	70	49	112	75	65	41	25	20	47	41	82	45	95	63	99	70	98	81	183	132	907	642	60
11	Belgaum	910	575	761	553	450	308	169	114	316	221	647	501	2,249	1,843	3,156	2,397	3,318	2,353	3,599	2,376	1,773	1,174	527	357	17,875	12,772	335
12	Dhárwár	2,359	1,869	883	693	258	221	125	26	128	79	129	72	308	222	801	576	1,781	1,376	2,743	1,917	1,750	1,364	901	768	12,066	9,183	382
13	Bijápur	272	364	283	159	129	88	47	36	26	5	43	12	166	117	471	227	638	526	916	752	692	538	252	250	3,935	3,074	124
14	Kánara..	48	27	53	52	43	33	3	3	1	1	80	46	142	110	17	14	75	68	60	54	18	11	25	12	565	431	22
15	Surat	60	37	161	90	126	81	57	42	84	70	102	72	221	160	332	258	418	303	376	311	172	120	108	62	2,217	1,606	62
16	Broach..	183	161	219	202	186	186	67	67	32	32	—	—	77	77	96	96	66	66	15	15	—	—	—	—	941	902	12
17	Kaira	306	306	273	273	296	296	172	172	72	72	2	2	97	65	204	184	167	107	50	37	6	2	—	—	1,645	1,516	64
18	Panch Mahals	379	278	342	342	77	73	—	—	6	6	1	1	—	—	—	—	—	—	—	—	—	—	—	—	805	700	*34
19	Ahmedabad	—	—	3	2	10	6	4	1	—	—	—	—	—	—	1	1	11	9	22	11	27	20	5	1	83	51	4
20	Karáchi	22	17	77	54	808	538	1,522	1,112	611	480	43	39	14	12	11	8	29	23	32	27	27	17	39	32	3,235	2,359	20
21	Hyderabad	—	—	—	—	6	3	27	18	33	29	—	—	—	—	164	133	345	285	390	354	96	87	14	13	1,075	922	19
22	Thar and Párkar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	Shikárpur	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	3	3	2
24	Jacobabad	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	1	1	1
	Total for the Presidency ..	8,607	6,933	8,884	7,429	11,016	8,964	6,984	5,303	3,643	2,955	2,403	1,826	9,492	7,343	18,328	13,992	23,420	16,974	20,188	14,526	8,168	6,322	5,154	4,029	120,987	96,596	* 2,256

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Khándesh.—Plague prevailed to a limited extent up to March, after which it fell rapidly until June, and the district was free during the month of July, In August, however, it was again re-infected and continued so up to October, when five deaths were recorded that month, when it ceased. Twenty-two towns and villages were affected, and there were 782 attacks and 620 deaths reported.

Násik.—Was affected during the whole of the year. From January to June it was to a limited extent, but it suddenly rose from 130 deaths in June to 768 deaths in July, and continued increasing until the maximum was reached in September, when 2,976 deaths were recorded; it declined just as rapidly, and the minimum was recorded in December, viz., 27 deaths. 154 towns and villages were affected, and there were 10,791 attacks and 8,441 deaths reported.

Thána.—Was affected during the whole year as in 1898. In January the disease was on the increase, and this continued until March, when the maximum number of deaths, 970, took place, and then gradually declined until December, when 152 deaths were recorded. The total for the year was 146 towns and villages, 4,996 attacks and 4,362 deaths.

Bombay City.—As in 1898, the disease was prevailing throughout the year. The maximum deaths, 4,758, were reached in March, when it rapidly fell until June, giving 228 deaths the minimum, and then again there was a gradual rise, and continued so until the close of the year, when 994 deaths were recorded. The total for the year was 19,454 attacks and 15,874 deaths.

Kolába.—Plague prevailed to a very limited extent throughout the year, it gradually declined from January until September, when only one death was recorded; at the last month of the year there were 43 deaths. 80 villages were affected and there were 1,070 attacks and 902 deaths reported.

Ahmednagar.—In the collectorate, plague occurred in all the tálukas except Karjat; the highest mortality, 1,173, occurred in September. Amongst the Registration Circles the highest number of deaths, 1,576, was recorded in the town of Ahmednagar. In the whole collectorate 93 towns and villages were affected, and there were 3,920 attacks and 2,681 deaths reported, the majority of which occurred in the Chief City and in the neighbouring villages in the Nagar Táluka.

Poona.—In the Poona Collectorate, plague occurred in all the tálukas. The maximum mortality, 5,947, took place in August. The greatest number of deaths from plague, 10,229, was recorded in the town of Poona. The Haveli Táluka, in which the city of Poona is situated, returned 5,037 more deaths from the disease. In the city, cases occurred in every month of the year. In the whole collectorate, 262 towns and villages were affected, and there were 25,239 attacks and 19,047 deaths reported.

Sholápur.—In the collectorate, plague prevailed in all the tálukas except the tálukas of Sángola and Málsiras. 818 deaths were recorded in the town of Sholápur during the latter five months of the year. It was present in the Sholápur Táluka during every month of the year except July, and 771 deaths occurred during the year. Pandharpur Town reported one imported death, but no local case. The total for the year was 59 towns and villages, 2,506 attacks and 1,767 deaths reported.

Sátára.—The collectorate was affected throughout the year and in all Registration Circles except Malcolmpeth. The highest mortality, 2,358, took place in October. Amongst the circles, Karád Rural Circle returned 2,405 deaths. The town of Karád recorded 908 deaths. In the whole collectorate 298 towns and villages were affected, and there were 12,175 attacks and 8,740 deaths.

Ratnágiri.—Was affected during the whole year, and in all the tálukas except Khed. The highest mortality, 132, was in December. There were 60 towns and villages were affected, and 907 attacks and 642 deaths occurred.

Belgaum.—As in 1898, the disease was prevalent during the entire year. In 1899 it had reached its minimum in April, but from that month it showed an increase, till in August the maximum was reached, and for the next two months the mortality was nearly the same, after which a decline set in. The total for the year was 335 towns and villages, 17,875 attacks and 12,772 deaths.

Dhárwár.—Was affected during the whole year. The year opened with 1,869 deaths in January, and the disease gradually declined till April, when the minimum, 96 deaths, were recorded; it again increased rapidly when the maximum, 1,917 deaths were reached in October, 382 towns and villages were affected, and there were 12,066 attacks and 9,183 deaths reported.

Bijápur.—The collectorate was affected throughout the year. The disease which had commenced in September 1898, was on the increase in Deecmber, but in January 1899 there was a sudden fall, which continued until May, when there were only five deaths. The mortality then rose to 12 in June. In July it assumed a greater intensity, and in October it reached the maximum, 752, and fell in November to 535, and in December to 250. In all there were 124 towns and villages affected, and 3,935 attacks and 3,074 deaths.

Kánara.—In July the epidemic reach its maximum. There were 22 towns and villages affected, and there were 565 attacks and 431 deaths.

Surat.—In this collectorate the plague was present in every month of the year, and in all the tálukas except Mándvi, Bárdoli and Chikhli. Bárdoli and Chikhli returned only one and three deaths respectively; the highest mortality, 311, occurred in October. Amongst the Registration Circles the highest number of deaths, 625, was recorded in the town of Surat. In all there were 62 towns and villages affected, and 2,217 attacks and 1,606 deaths.

Broach.—In the collectorate the largest number of deaths was recorded in the first quarter of the year, and then the epidemic declined. In the last two months of the year the district was free. Broach Town Circle suffered most heavily. Twelve villages and towns were affected, and there were 941 attacks and 902 deaths reported.

Kaira.—Plague prevailed chiefly in the first quarter of the year, and then, with a slight recrudescence in August and September, decreased, till in December no cases were reported. Sixty-four towns and villages were affected, and there were 1,645 attacks and 1,516 deaths reported.

Panch Mahál.—The chief mortality occurred in the first two months of the year, the epidemic declining till it ceased in July. Amongst the Registration Circles the highest number of deaths, 456, was recorded in the town of Godhra. In all there were 34 towns and villages affected, and 805 attacks and 700 deaths reported.

Ahmedabad.—In this collectorate, Dhandhuka Registration Circle returned 39 deaths, while 12 deaths were reported from Ahmedabad Town Circle.

Karáchi.—The plague was at its highest intensity in March, April and May, after which it was kept within narrow limits. Karáchi Town Circle suffered the most during the year. In the whole collectorate 20 towns and villages were affected, and there were 3,235 attacks and 2,359 deaths reported.

Hyderabad.—The district was not badly affected till the latter half of the year, but in December a decline set in. Altogether 19 villages were affected, and 1,075 attacks and 922 deaths reported.

Shikárpur.—In this district three imported cases and three deaths were imported during the year.

Jacobabad—In this collectorate the only case and death reported was an imported one.

In the whole Presidency there were 126,287 attacks, and 96,596 deaths from plague, and 2,256 towns and villages were affected, as compared with 110,360 attacks and 86,191 deaths and 1,188 affected towns and villages in 1898. The parts most affected were the collectorates of Poona, City of Bombay, and Belgaum, and the rates of plague deaths per 1,000 in them were 17·9, 19·6 and 12·6 respectively. Násik came next with a rate of 10·03, and then Dhárwár, Sátára, Thána, Karáchi, Bijápur and Ahmednagar, with rates which ranged from 8.7, 7·1, 5·3, 4·2, 3·8 and 3·02 per 1,000; Broach, Surat, Sholápur, Panch Mahals had rates 2·6, 2·4, 2·3, 2·2, respectively; the rates of the remaining affected collectorates were much lower. The rate per 1,000 for the various Registration Districts were as follows:—Western 6·68, Central 6·53, Southern 7·70, Gujarát 1·54 and Sind 1·15.

In January there were 6,933 deaths, and during February and March it rose to 8,961. In April the deaths fell, and continued to fall until the minimum (1,826) was reached in June, they rose again in July and August, and a more distict rise took place in September,

when the maximum (16,974) was recorded, after which a fall took place in October, and continued falling until December.

Dysentery and Diarrhœa.—Dysentery and diarrhœa caused the deaths of 40,348 males and 34,388 females, or a total of 74,736 persons, against 56,789 in 1898 and a decennial mean of 43,918—an increase of 17,947 against the last year and of 30,818 over the decennial mean.

The deaths ascribed to these diseases during the nine years preceding 1897 showed only very slight variations, but in and since 1897 the deaths showed a considerable increase and amounted to nearly double that of any of the nine years already mentioned. The increase has been continued during the present year, though smaller than the year 1897, yet the total is still considerably over any of the nine years previous to 1897. The rate (3·97) was higher than in the year 1898 (3·02). The increase, as in the last two years, is chiefly in the Western and Central Registration Districts, and is most noticeable in the parts affected by famine. The collectorate of Sholápur heads the list with a high ratio of 9·60, Khándesh follows with a ratio of 9·43, Poona with 7·59, Násik with 7·44, and Sátára with 5·95 and the City of Bombay with 5·28. In the Southern Registration District in the Bijápur Collectorate the ratio during the year is higher than the last year and the ten years' mean. In the Gujarát District also there is an increase in every collectorate in the number of deaths ascribed to "dysentery and diarrhœa," but the figures are not high, considering that the district is famine-stricken.

Injuries.—During 1899, 4,108 males and 2,994 females, or a total of 7,102 persons, met with violent deaths. The mortality from these causes is more by 118 than that reported in 1898. Of the 7,102 deaths, 2,772 occurred from drowning, 1,444 resulted from snake-bite, 828 from wounding, 157 from hanging, 109 from poisoning, 90 from attacks by wild beasts, and 1,702 from other causes.

Other Causes.—The recorded deaths from causes other than those specified number 254,872, of which 130,684 occurred among males and 124,179 among females. The total for 1898 was 176,335, so there is an increase of 78,537. Under this heading all deaths are included which cannot be classed under cholera, small-pox, fever, plague, dysentery and diarrhœa or injuries. They have been increasing gradually for the last eleven years, and are now more than treble what they were 11 years before. The increase became more pronounced in 1897 and has continued up to the present year, and will probably be even more next year.

Sanitary Works.

All available information under these sections has been thrown in a tabular form, and will be found in Appendices IV and V.*

There were 166 Municipalities in the Mofussil, with a population of 2,200,455 souls, and an income of £368,446. Out of this income, £182,924, or 49·65 per cent., were allotted for sanitary works, and out of this allotment, £155,778, or 85·16 per cent., were spent. Out of the total expenditure, £67,000, or 43·01 per cent., were spent on conservancy; £31,103, or 19·97 per cent., were spent on improvement of water-supply; £9,398, or 6·03 per cent., on improvement of town sites; £4,172, or 2·68 per cent., were spent on construction and repairs of markets and slaughter-houses; £2,438, or 1·56 per cent., were spent on sanitary arrangements during fairs and festivals, and £41,669, or 26·75 per cent., were spent on sanitary objects, including construction and repairs of tanks, &c.

The Bombay Village Sanitation Act of 1889 has been introduced in five other villages during the year 1899, and abolished in four villages, making a total of 300 since the introduction of the Act in the year 1895, against 299 in the previous year. The committees at Vejalpur in Kálol Taluka of the Panch Maháls District, at Bhadiad and Detraj in the Dhandhuka and Viramgám Tálukas, respectively, of the Ahmedabad District, and at Bulri in the Guni Táluka of the Hyderabad District—in all in four villages—have been abolished, and in five villages, viz., Kálol in Kálol Táluka of the Panch Maháls District, Khatian in Hyderabad Táluka, Old Hála and Bhitshah in Hála Táluka and Beravi in Shahdádpur Táluka of the Hyderabad District, the Act has been introduced and committees established during the year 1899. As the attention of the district

* Not reprinted.

officers has been engaged on famine, no progress has been made in the establishment of village committees under the Village Sanitation Act.

The total number of selected villages in which the Village Sanitary Inspection Book has been introduced during the year is 3,225 against 3,199. Out of this number, five books in the Poona and Sholápur Districts in the Central Registration District, and 12 books in the Hyderabad and Thar and Párkar Districts of the Sind Registration District, have been written up by the Deputy Sanitary Commissioners of those districts, and 342 books in 18 districts have been written up by the Inspectors of Sanitation and Vaccination. Owing to the absence on leave and deputation of the Deputy Sanitary Commissioners on either cholera or famine duty, a greater number of books have not been written up.

Personal Proceedings and General Remarks.

I was in charge of the Department up to 13th January, 1899, when I proceeded on furlough, handing over charge to Lieutenant-Colonel A. W. F. Street, D.S.O., I.M.S., the Senior Deputy Sanitary Commissioner present. This officer in his tour of inspection visited the following places :—Surat, Ahmedabad, Talegaon, Kurla, Kurvandi, Lánowli, Karli, Pandharpur, Poonah, Thána, Dhanora, Modha and Khadakvásla, and when famine relief works were about to be opened in Gujarát, he again visited Ahmedabad, Godhra, Broach, Mehmadabad and Punej, during the month of October, and returned to Poona on 3rd November to hand over charge to Lieutenant-Colonel O. H. Channer, M.B., D.P.H., I.M.S., who took charge on 5th November, and continued to act until the end of the year. During the whole of December Dr. Channer was engaged in the Gujarát Districts, *viz.*, Ahmedabad, Kaira and Broach, in making all the necessary medical arrangements for the new famine relief works that were being opened.

I append a report on the famine work done up to 31st December, 1899.

Report on the Medical Administration of Relief Works during the portion of the year under Report when the Bombay Presidency was affected by Famine.

On the 31st of July of the year under report the monsoon current was reported by the Meteorological Reporter for Western India to be very weak in the Bay of Bengal, and to be becoming weaker day by day in the Arabian Sea, instead of showing any signs of improvement there. There was no monsoon on the Malabár Coast, and only a slight gradient on the West Coast. The skies were becoming more or less clear, and the winds variable in direction. Under such circumstances the prospects of rain were poor, and great anxiety arose throughout the Presidency, especially in Khándesh, Gujarát and Sholápur. On the 31st of August there was no monsoon on the Malabár Coast, while between Bombay and Kárwár the gradient was only about half of the normal. From the following tabular statement comparing the rainfall between the 1st of June and that date at Sholápur, Khándesh, Broach, Ahmedabad and Káthiáwár with the average rainfall for that period and the total average annual rainfall it will be seen that the rains had completely failed in those districts. All crops, especially food-grains, were suffering from the continued drought, and some had been irretrievably ruined :—

Provinces or Districts.	Stations.	Rainfall.		
		From 1st June, 1899, to 31st August, 1899.	Average.	
			From 1st June to 31st August.	Annual.
		In. cents.	In. cents.	In. cents.
Khándesh	Dhulia	6 28	14 12	22 47
	Jalgaon	6 75	24 44	33 42
Broach	Broach	9 25	30 11	38 51
Ahmedabad and Káthiáwár	Viramgám	3 93	25 15	30 95
	Wadhwán	3 06	13 45	18 14
	Dholera	8 74	22 48	30 46
	Bhávnagar	6 02	17 10	22 58
Sholápur	Bársi	6 19	17 14	35 90
	Sholápur	3 09	14 92	29 62

Widespread scarcity being, therefore, threatened, and Government having issued certain Resolutions in July and early in September in connection with it, Lieutenant-Colonel Street, I.M.S., Acting Sanitary Commissioner, lost no time in placing himself in personal communication with the Commissioners of the several divisions while they were all in Poona, and especially with the Commissioner of the Northern Division, in order to be prepared to carry out such famine duties as pertained to his office as soon as occasion should arise.

From reports of the Commissioners it became evident in about the first week of September that in many parts of the Presidency the condition of agricultural labourers had become precarious. Test works were accordingly opened in the Kaira, Ahmedabad and Panch Maháls Districts at once. On or about the 10th of September four test works were started in the Belgaum District, the Collector of Dhárwár was reported to have taken steps to open test works in his district, and about this time the Commissioner of the Southern Division reported that large numbers of people were leaving the Ratnágiri District for Bombay. The Commissioner of the Central Division reported that he was arranging for the drawing up of a programme to determine, if the late rains should fail, when and where large central works should be opened, proposing, meanwhile, to treat as test works small projects entered in the current year's Provincial Budget in any case where Local Fund works were not available for the purpose. Very soon after test works were started in the Ahmednagar and Sholápur Districts.

It was before long manifest, from the numbers of people willing to accept famine wages on the test works, that famine works would have to be started on a large scale. On receipt of a report that this was about to be done in Ahmedabad, Lieutenant-Colonel Street immediately went to Gujarát and took all the necessary steps to make the medical and sanitary arrangements for the camps, following the lines detailed in Section X. of the Thirty-fourth Annual Report of the Sanitary Commissioner for the Government of Bombay, 1897. He then placed these camps in charge of the Deputy Sanitary Commissioner, Gujarát Registration District.

By Government Resolution No. 6534 (Famine), dated the 18th September, 1899, the recommendations in paragraphs 429–460 of the report of the Famine Commission of 1898 were provisionally adopted, with the modifications—

(1.) That the wage of Class I. should be 19 chataks;

(2.) That the wage of Class III.—working children—should be 12 chataks, and that they should be subject to fine; and

(3.) That the minimum wage for adults in Class IV. should be 13 chataks.

Other amendments to the Bombay Famine Code had reference to the point on which statistical information should be recorded, a revision of existing forms being directed in accordance with the recommendations of the Commission, due regard being had to the proposals of the Special Committee appointed to report thereon.

On the 16th of September Lieutenant-Colonel Street applied to Government to revive certain Government Resolutions published in 1896 and 1897, relating to expenditure in connection with, and arrangements for, the management of hospitals attached to large relief works, and to the appointment of District Medical Officers and their establishments, &c.

Government, however, ruled that all applications for funds required by the Sanitary Commissioner for the purposes indicated should be submitted to Government through the Public Works Department, and that he should apply for the requisite sanction regarding the appointment of District Medical Officers when necessary, following in his proposals the precedents created in 1896–97.

New works were opened during the first half of October at Kaira, Khándesh, Thána, and Thar and Párkar, in Sind.

Lieutenant-Colonel Street continued, as new works were opened in Gujarát, to make all the necessary medical and sanitary arrangements, he systematically visiting in the Ahmedabad and Kaira Districts, and the Deputy Sanitary Commissioner, Gujarát Registration District, in the Panch Maháls and Broach Districts.

On the 16th of October he reported to Government that in his opinion the time had come for the appointment of District Medical Officers, under Section 24 (*b*) and Section 48 (*a*) Famine Code, in the Ahmedabad, Kaira, Panch Maháls and Broach Districts. His representation led to the issue of Government Resolution No. 7690 (Famine), dated 28th October, 1899, sanctioning the appointment of three District Medical Officers —one for Ahmedabad, one for West Kaira and Broach, and one for East Kaira and Panch Maháls, the railway being the dividing line between East and West Kaira.

The first two District Medical Officers, viz., Captain W. G. Richards, I.M.S., for Admedabad, and Captain G. O. F. Sealy, I.M.S., for Kaira and Panch Maháls, were appointed on the 30th of October.

By Government Resolution No. 7797 (Fam.), dated 2nd November, 1899, the Collector of Ahmedabad was requested to furnish to Government, through the Commissioner of the Northern Division and the Sanitary Commissioner, a detailed report of the doubtful cases of deaths from starvation mentioned in the remarks accompanying Statement E, for his district, and the Sanitary Commissioner was requested to show, in future mortality returns, the estimated plague mortality in districts where plague was severe, and deducting it from the total mortality, the net estimated mortality due to other causes than plague.

On the 4th November Lieutenant-Colonel Street reported to Government that he had visited the relief works in the Ahmedabad and Kaira Districts and in the táluka of Jalgaon in Khándesh, and that the condition of the people was generally satisfactory and their health fair, as was also the state of things in the Panch Maháls, the camps of which district had been visited by the Deputy Sanitary Commissioner, Gujarát Registration District, who, moreover, reported that he did not observe any signs of distress among the people in several villages which he had inspected. Lieutenant-Colonel Street referring to four cases (with two deaths) of suspicious fever in the Chandola Relief Camp gave it as his opinion that they were not cases of famine fever.

Lieutenant-Colonel Street, D.S.O., I.M.S., was relieved by Lieutenant-Colonel O. H. Channer, D.P.H., I.M.S., who took over charge of the duties of Sanitary Commissioner on the 6th November, 1899.

By Government Resolution No. 8062 (Fam.), dated the 13th November, 1899, the opinions of the Commissioner in Sind, the Commissioners of Divisions, and the Sanitary Commissioner were called for on the points mentioned in a circular letter from the Government of India, having reference as to whether any definition of *starvation deaths*, or any distinction between *starvation* and *privation* deaths could be suggested which could be prescribed for practical adoption, and to meet the request made in 1892 by Her Majesty's Secretary of State for India that all deaths from *starvation* should be entered in returns, difficulty having been experienced in the last famine in distinguishing between actual deaths from *starvation* and deaths from disease accelerated by *privation*.

During November more test and relief works were opened in the Nagar, Sholápur, Khándesh, Poona, and Belgaum Districts, and proposals were made to start works in the Bijápur District.

By Government Resolution No. 8703 (Fam.), dated the 5th December, 1899, the Sanitary Commissioner was requested to submit regularly to Government weekly reports regarding the condition of people on relief works and of inhabitants of affected villages. Also to direct that District Medical Officers should make rapid tours through their respective districts, submitting fortnightly reports on the condition of people visited by them in villages and camps, and that they should endeavour to visit, in the course of their tours, some of the remoter villages, as well as those in proximity to the general lines of communication.

Captain F. D. Browne, I.M.S., was appointed as District Medical Officer for the district of Ahmednagar on the 16th of December.

Up to the end of the year, thirty-six Assistant Surgeons and Hospital Assistants were employed on famine duty. More could have been advantageously employed had any been available. Besides these, a number of dispensary medical officers attended famine camps in addition to their own duties.

Owing to the small number of District Medical Officers, and the heavy organizing work thrown upon the Deputy Sanitary Commissioners of the different districts, it was not possible, before the end of the year, to conduct observations sufficiently exhaustive to warrant the deduction of any conclusions as to the value of the measures adopted. In many parts, moreover, famine had only just commenced before the end of the year. Observations, however, conducted since that date, and experience gained will doubtless afford many indications for the adoption of measures which will enhance the value of that most important branch of famine administration, its Medical Department.

Plague, as in the last famine, was practically non-existent in the open well ventilated camps, and among people leading an out-of-doors life. There were no admissions from cholera during the year into any of the famine relief camp hospitals, and only 21 cases of small-pox, 19 of which were in the hospitals in the Khándesh Collectorate, one in the Ahmednagar, and one in the Kaira Collectorate.

A brief review of each affected district is given below up to the end of the year from the 1st of September.

Khándesh.—Test works were opened in this district in September and freely resorted to. Early in October some of the test works were converted into regular famine relief works. These were visited by Lieutenant-Colonel Street, who organized all the medical and sanitary measures. The price of jowári and bájri in October averaged from 14 to 18 lbs. per rupee, against 52 and 44 lbs. for these grains respectively in October, 1895. There were 303 admissions into famine relief camp hospitals, and 30 deaths. Among those admitted there were 19 cases of small-pox, but none of cholera or plague. Besides the in-patients, 1,303 out-patients were treated. At the close of the year there were 19 relief works. The average daily number of *workers* during the week ending the 30th of December was 164,090 ; of *dependants* 11,114 ; and of those in receipt of gratuitous relief 198 (in four villages).

Ahmedabád.—Test works were opened early in September and rapidly extended, many being soon converted into regular famine relief works. Lieutenant-Colonel Street, and after him Lieutenant-Colonel Channer, I.M.S. (who succeeded him as Acting Sanitary Commissioner in November), spent much time in organizing the necessary medical and sanitary arrangements, and in travelling about and supervising the work of the Medical Officers. No sowing operations could be carried out, except where well irrigation was possible. The condition of the cattle was very bad, large numbers being sent to grazing grounds, and over 2,000 being in cattle relief camps in December. Between July and December the price of jowári ranged from 17 to $18\frac{7}{8}$ lbs. for the rupee, and that of bájri from $15\frac{2}{5}\frac{9}{0}$ to $16\frac{3}{4}$ lbs. As many as 2,220 were admitted into hospitals, of whom 562 died. There was no cholera, plague or small-pox, but dysentery accounted for 578 admissions, diarrhœa for 383, and fever for 678. Besides the in-patients, 4,508 out-patients were treated. At the close of the year there were 12 relief works and two test works. The average daily number of *workers* during the week ending the 30th of December was 37,383 ; of *dependants* 8,980 ; and of those in receipt of gratuitous relief 4,150 (in 308 villages), and 3,670 (in poor-houses).

Kaira.—Works were opened in this district also early in September. Water in the tanks was rapidly drying up, and the supply of fodder was being rapidly exhausted, and large numbers of cattle were dying. During the week ending the 9th of September the average daily numbers on works had risen to 3,649. Between July and December the price of jowári ranged from $16\frac{1}{4}$ to $18\frac{1}{3}$ lbs. per rupee, and that of bájri from $14\frac{1}{2}$ to $16\frac{5}{1}\frac{}{4}$ lbs. There were 836 admissions into hospital and 128 deaths. There was no cholera or plague, but one case of small-pox. Ninety-three admissions were due to dysentery, 189 to diarrhœa, 149 to fevers, and 267 to emaciation. Besides the in-patients, 1,065 out-patients were treated. A District Medical Officer was appointed on the 30th of October. At the close of the year there were seven relief works. The average daily number of *workers* during the week ending the 30th of December was 11,807 ; of *dependants* 1,865 ; and of those in receipt of gratuitous relief 1,053 (in 242 villages), and 858 (in poor-houses).

*Panch Mahál*s.—Works were started early in September and on the 2nd there were over 800 being relieved. The want of rain was felt at a very early date, and fodder became very scarce. This affected the cattle seriously and many died. Sowing operations were attempted where well irrigation was possible, but towards the end of November hope was given up of obtaining any rabi crop. During the famine months the price of maize ranged from 16 to $18\frac{2}{3}$ lbs. per rupee, and that of bájri from 14 to $16\frac{1}{2}$ lbs. There were 60 admissions into relief camp hospitals and five deaths. None of these admissions were due to cholera, plague or small-pox. Besides the in-patients, 165 out-patients were treated. The medical arrangements were at first in the charge of the Deputy Sanitary Commissioner, Gujarát Registration District, but a District Medical Officer was appointed on the 30th of October. At the close of the year there were five relief works. The average daily number of *workers* during the week ending the 30th of December was 13,361 ; of *dependants* 2,209 ; and of those in receipt of gratuitous relief 95 (in 14 villages).

Broach.—Test works were opened in September, and, being freely attended, soon developed into regular famine relief works, and for the week ending the 30th September the average daily number being relieved exceeded 2,000. During October the supply of grain was insufficient, fodder was being largely grown by well irrigation, and wells were being dug freely. About the middle of that month the standing cotton crop was

estimated to be 10 annas in Anklesvar, 8 annas in Broach, and insignificant elsewhere. At Jambusar it was being used for fodder. The jowári crop was estimated to be 4 annas in Anklesvar, and elsewhere practically *nil*. In November large numbers of cattle were sent to graze in the Thána forest land. The numbers on relief works continued to increase, and in December poor-houses were opened, first at Vágra, Broach and Anklesvar, and soon after in all the tálukas. The average daily number on relief during the week ending the 16th December exceed 4,000. Between July and December the price of jowári remained fairly stationary at between 17 and 18 lbs. per rupee, and of bájri between $15\frac{1}{6}$ and $16\frac{2}{3}$ lbs. There were 87 admissions into relief camp hospitals and 12 deaths. Thirty-five of the admissions were cases of child-birth. Besides the in-patients there were 1,959 out-patients treated. No epidemic disease. At the close of the year there were 14 relief works. The average daily number of *workers* during the week ending the 30th of December was 64,070 ; of *dependants* 9,089 ; and of those in receipt of gratuitous relief 3,953 (in 401 villages), and 390 (in poor-houses).

Surat.—About the first week of October rain was beginning to be urgently needed to save some of the crops. There was, however, no hope of saving any of the fodder crops, and the price of grass was so high that many of the cattle were sent to graze in the Dang country. The labouring classes finding but little to do in the fields were maintaining themselves chiefly by selling fuel and grass-cutting. A test work was opened at Dehan towards the end of October, and during the week ending 2nd December a daily average of 7,990 people were on relief. More test works followed soon after in Olpád and Mándvi, and were freely resorted to. No admissions into any hospital were reported before the end of the year among those on relief. The price of food-grains rose in October slightly, and remained more or less stationary till the end of the year, up to which time also the condition of the people, excepting those in the Olpád and Mándvi tálukas, was fair. At the close of the year there were two relief works. The average daily number of *workers* during the week ending the 30th of December was 5,299 ; there were no *dependants* and none in receipt of gratuitous relief.

Thána.—In December the condition of cultivators and cattle was satisfactory, and there was, for the time, sufficient employment for agricultural labourers and wild tribes. People from above the Ghauts were, however, coming into Sháháda, Mokháda and Kalyán in search of work. Beggars also and other immigrants from Gujarát and Káthiáwár were flocking into Kalyán, Bhiwndi and other parts. The numbers on Local Fund works at Dáhánu and Umbargaon were increasing, and it was proposed to convert these into famine test works in the following month.

Ahmednagar.—Test works were started in September in this district and freely resorted to, there being about 1,900 average daily workers during the week ending the 7th October. Two hundred people from Native States had come on to the test work in Nevása, and later on 500 more came. About the middle of October, the condition of agricultural labourers was reported to be deteriorating, and that of weavers to be getting bad. During the last week in October about 7,000 persons were on test works, and the condition of labourers and weavers was getting worse. Early in November more test works were opened, and later on in the month some test works were converted into regular famine relief works. About the middle of December there were six relief works and eight test works, and during the week ending 16th December an average daily number of over 18,000 on relief. A District Medical Officer was appointed on the 16th of December. The price of jowári in November and December ranged from $16\frac{3}{8}$ to $17\frac{1}{7}$ lbs. per rupee, and of bájri $16\frac{2}{3}$ to $16\frac{1}{3}$ lbs. Only 16 admissions and one death were reported in Famine Relief Camp Hospitals during the year. One of these was a case of small-pox, but none were due to cholera or plague. Besides the in-patients, 159 out-patients were treated. At the close of the year there were 10 relief works and four test works. The average daily number of *workers* during the week ending the 30th December was 53,505 ; of *dependants* 7,945 ; and of those in receipt of gratuitous relief 1,371 (in 549 villages).

Sholápur.—Early in October, the price of food-grains rose generally throughout the district on account of extensive exports of grain to Gujarát and Káthiáwár. This caused much distress among the poorer classes, and crowds of beggars flocked into Sholápur City some of whom (chiefly lepers and the blind and infirm) were admitted to gratuitous relief to prevent actual starvation. About the middle of October the local demand for labour was insufficient to meet requirements, and 958 persons in Sholápur City were getting gratuitous relief, 959 in Sángola táluka, and 49 in Málsiras táluka. A test work had been opened on the 10th, and workers joined on the 14th. Other test works were opened

in Sángola and Bársi tálukas soon after and were freely resorted to. More test works were started in November, and during the week ending the 2nd December nearly 15,000 people were being relieved. Towards the end of December there was a daily average of nearly 60,000, and many of the test works were converted into regular famine relief works. During the famine months, the price of jowári ranged between 17½ and 22⅜ lbs. per rupee, while bájri remained stationary at about 18⅘ lbs. Only two admissions into Relief Camp Hospitals were reported during the year, late in December. At the close of the year there were 14 relief works. The daily average number of *workers* during the week ending 30th of December was 64,678; of *dependants* 22,552; and of those in receipt of gratuitous relief 5,070 (in 376 villages).

Násik.—Early in October the want of rain commenced to be felt and crops were withering. Cattle in the plains commenced to suffer from scarcity of water and fodder. The condition of cultivators was middling, of labourers bad, and of artizans fair. Two test works had been started and two more followed, and during the week ending the 4th November over 2,000 people were on relief. During November another test work was opened and freely resorted to. In December many of the test works were converted into relief works, and the numbers of workers rose. In November and December the price of jowári ranged from 16⅗ to 18⅜ lbs. per rupee, and of bájri from 16½ to 17 lbs. No admissions into hospitals were reported among those on relief during the year. At the close of the year there were two relief and five test works. The average daily number of *workers* during the week ending the 30th of December was 19,401; of *dependants* 2,883; and of those in receipt of gratuitous relief 218 (in 93 villages).

Poona.—In September jowári was 23½ per rupee and bájri 21 3/10 lbs. Jowári remained stationary in October, but bájri became dearer, and early in that month distress commenced among low caste people and low paid village servants. Labourers and agriculturists soon commenced to feel distressed also, on account of high prices and the coming to a standstill of agricultural operations in consequence of want of rain. So far no noticeable change was observed among hill tribes who were engaged in the collection of hirdas. Test works were started, and during the last week of October over 1,000 workers had resorted to them. In November more test works were successfully started, and towards the end of that month one relief work as well. There was no marked deterioration in the condition of the people, but lack of employment drove them to the works. The condition of weavers, artizans, and hill-tribes remained satisfactory throughout December. No admissions into hospitals were reported before the end of the year among workers. The daily average number of persons on works during the week ending the 30th of December was 12,185, and of those in receipt of gratuitous relief 1,302 (in 518 villages).

Sátára.—In September two tests works were started in this district, the prices of food having risen in several tálukas, and distress being felt by the poorer classes, especially at Khánápur, Khatáv and Khándála. Soon after five other test works were started, and the daily average number on relief was, during the week ending the 21st October, nearly 2,000. The numbers gradually rose, but up to the end of the year no regular famine relief works were started. During the week ending the 30th of December there were four test works, the average daily number on these works was 12,482, and there were 206 *dependants*.

Bijápur.—Early in October the poorer classes suffered from the rise in prices of food-grains in consequence of extensive export of grain into Gujarát, and one test work was opened. The numbers of workers slowly rose, and more test works were open, but up to the end of the year it was not found necessary to open any regular famine relief works. During the week ending the 30th of December there were three test works and an average daily number of 3,861 *workers*.

Belgáum.—At the close of the year there were three test works in this district, with an average daily number, during the week ending the 30th of December, of 1,694 *workers*.

Dhárwár—At the close of the year there were two test works in this district, with average daily number, during the week ending the 30th of December, of 199 *workers*.

Report of the Sanitary Board for the Year 1899.

Preliminary.—Plague and famine have again pressed heavily on Municipalities, and we can only draw attention to paragraph 1 of our report of last year.

Hyderabad.—The municipality, owing to dissensions amongst themselves, have been very dilatory in constructing the engine house at the river lift at Giddu, and in erecting the new engines. The necessity for having the latter working before the hot weather has been strongly urged on the President.

The plans and estimates, prepared by the Sanitary Board, for the final completion of the water works, are still under consideration by Government.

Ahmedabad.—The drainage scheme, prepared by Mr. Baldwin Latham, is still under discussion; but little progress is likely to be made until a special engineer is put in charge, as the local Executive Engineer's time is so fully occupied.

Kaira.—At the request of the Collector, the Sanitary Engineer went more fully into the matter referred to in paragraph 6 of last year's report. The details necessary for getting up the project are ready, and will be worked up as soon as the Poona Drainage Scheme is disposed of.

Mehmadabad.—A similar remark applies to this place, *vide* paragraph 7 of last year's report.

Yeola.—Practically no progress was made with the water works for this town. Up to March, 1899, the expenditure was £3,746, out of the estimated cost of £8,528. It is still under consideration whether the machinery and pipes should be obtained through the Secretary of State, or purchased locally. The work is under the Public Works Department, but the Executive Engineer states that he cannot spare any time for this work.

Ahmednagar.—The completion of the Kapurwadi tank is now being carried out as a famine relief work. It is hoped that it will be finished before the monsoon, as the wells seem to be all drying up, and the sub-soil water apparently is disappearing altogether from above the rock-level. The distribution scheme for the remaining two-thirds of the town, in connection with this tank, will shortly be forwarded to Government; but unless they grant a loan it will be impossible to carry it out.

Poona.—The drainage scheme prepared by the Sanitary Engineer was generally approved of by Government, and by the municipality; and also by Mr. Santo Crimp, whose presence in Bombay was taken advantage of by the municipality. On his advice, an effluent farm was finally adopted by the municipality; and the original scheme is now being altered, by doing away with the Septic tanks at the out-fall, which were necessary if the effluent was to be turned into the river instead of on to a farm. The out-fall can now be lowered some 15 feet, thus extending the gravitation area, and reducing the Shone system area. The sewers will discharge into a balancing tank, capable of holding 7½ per cent. of the day's maximum flow; and it will be pumped thence, by Worthington Triple Expansion Engines, through a 25-inch steel main, for a distance of 6½ miles; and with a lift, including friction, of 190 feet to the out-fall. There it will be passed through macerating tanks, as at Wimbledon; and the effluent will be used for crops. The experiments made with fodder crops irrigated with the effluent showed startlingly successful results, in comparison with heavy dressings (20 tons per acre) of poudrette, and of farm yard manure. The comparative crops of sugarcane on the effluent, and on these manures, will be cut, and the juice tested, about the end of April; and if this is as successful as the fodder crops, the scheme will practically cost the municipality nothing, provided the farm is worked intelligently by a trained European, as suggested.

A water-supply scheme for the city is also under preparation by the Sanitary Engineer, in order to provide a sufficient head for the water-closets in the higher portions of the city, and a better supply and distribution all over the city. Both projects will probably be ready for final discussion in June; but here again, without Government assistance in the shape of a loan, and a favourable rate for the canal water, nothing can be done.

Akalkot.—The oil engines, which were almost a new departure in this country, have been working so satisfactorily that their extended use for small projects will probably be adopted.

Regarding the other towns and projects referred to in last year's report, no progress has been made, and each year only enforces the urgency of the matter referred to in paragraph 19 of last year's report; especially in a year like this, when every executive engineer is over-worked, owing to famine relief.

Miscellaneous.—The Board advised on the proposals for water-supply to the Central Jail at Hyderabad, on the Ahmedabad Sewage Farm and on the water-supply to Government House, Mahábaleshvar. The Sanitary Engineer, in conjunction with the Collector, also reported on the military proposals regarding the sanitation of the Kamatipura section of the Sadar Bazár at Poona. The plan and estimate for the drainage scheme of the Sadar Bazár have been sent to the Military authorities, with a view to its being carried out at the same time as the city scheme.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER, 1899.

The following table gives a summary of the shipping and health of the Port of Bombay, and of the work in connection therewith, for the year ending 31st December, 1899 :—

Vessels including Country Craft.	Number of Vessels inspected.	Number of Persons inspected, including Crew on Vessels.	Number of Native Crew and Third Class or Deck Passengers disinfected during the period extending from 14th February to 31st December.	Number of Vessels disinfected.	Number of Persons Vaccinated.	Number of Persons segregated or rejected.	Diseases and Number of Cases of each.						
							Plague.	Cholera.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Jigger.
Entered	1,198	76,910	3,485	32	32	238	4	—	1	2	5	7	168
Left	64,594	1,116,429	44,864	—	—	17,424	117	—	—	—	—	—	—
In Harbour during the year ...	30	—	—	30	—	—	34	1	1	5	—	—	—
Total	65,822	1,193,339	48,349	62	32	17,662	155	1	2	7	5	7	168
1898	71,498	1,207,571	—	49	150	19,138	118	5	6	4	3	10	—

The foregoing table shows that 65,822 vessels of all sorts, with 1,193,339 crew and passengers, were examined during the year. The number includes every person who left Bombay by sea during the year, as well as those who arrived from certain infected ports.

It further shows that the clothing and bedding of 44,864 native crew and third-class or deck passengers who sailed on vessels for ports out of India were disinfected during the period extending from 14th February to 31st December, 1899. It also shows that the baggage of 862 returning pilgrims and 2,623 deck passengers who arrived from East African (Jigger infected) ports was disinfected.

The total number of plague cases detected during the year 1899 in connection with the shipping was 155 against 118 for the year 1898.

The following table furnishes further particulars regarding vessels which entered the port during the year 1899 :—

Year.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers only.	Total Number of Native Sailing Craft which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers only.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Indian Ports.	Number of Passengers only.	Total Number of Native Sailing Craft which entered Bombay Harbour from Indian Ports.	Number of Passengers only.
1899 ...	527	25,660	250	484	1,375	309,915	44,267	6,001
1898 ...	557	28,484	281	215	1,542	269,725	40,190	1,986

The total number of persons, including crew who arrived by these vessels, cannot be given, as no record is kept of the number of crew on most of the vessels entering the port. Of the 342,060 passengers who are shown in the above table, 10,520 were troops, 862 Mecca pilgrims, and the remaining 330,678 principally passengers from ports in close proximity to Bombay.

The following table gives the number of ships which had infectious disease on board on or before entering the harbour :—

Class of Vessels.	Number of Ships.	Total Number of Crew and Passengers inspected.	Number of Passengers from East Africa disinfected on account of presence of Jigger among them.	Diseases and Number of Cases of each.						Number of Persons Vaccinated.
				Plague.	Small-pox.	Measles.	Scarlatina.	Chicken-pox.	Jigger.	
Troop-ships	1	1,313	—	—	—	—	5	—	—	—
Vessels from Jigger-infected Ports ...	23	4,633	2,623	—	—	—	—	—	168	—
Other Vessels	8	1,678	—	4	1	2	—	7	—	32
Total	32	7,624	3,623	4	1	2	5	7	168	32
1898	20	12,321	—	5	8	3	3	5	—	150

Vessels which became infected while in port are not shown in the above table, but are noticed in the table on page 190.

Five cases of scarlatina which are shown in the foregoing table as having occurred on board a troop-ship were landed and isolated in the Military Cantonment at Colába. One of the P. & O. steamers arrived with a case of small-pox amongst her European passengers. The case was removed to the Saint George's Hospital, and such of the persons amongst the crew and passengers as were found unprotected by previous vaccination or small-pox, and who were willing to submit to it, were vaccinated. The total number of persons thus vaccinated was 32.

One vessel arrived with two cases of measles and three vessels with seven cases of chicken-pox. The cases of measles and chicken-pox were removed to hospitals on shore, and the necessary precautions for the disinfection of the vessels were taken.

Three steamers entered the harbour each with a case of plague on board, and one landed a native passenger suffering from plague at an intermediate port during her voyage from Hongkong to Bombay. The three cases of plague were sent for treatment to the Plague Hospital, and the ships by which they arrived were thoroughly disinfected in accordance with the Venice Convention Regulations.

It will be seen from the foregoing table that 23 vessels with 4,633 crew and passengers arrived at the Port of Bombay from Jigger infected ports on the south-east coast of Africa, 168 persons were found to be suffering from Jigger and ulcers due to Jigger, and were removed to the Goculdas Tajpal Hospital for treatment. In each case where sand ballast was found on a Jigger infected ship it was discharged into the sea and the vessels were thoroughly disinfected with carbolic solution or perchloride of mercury of the prescribed strength. The clothing, and effects of all passengers on ships among whom Jigger cases were detected were thoroughly disinfected in a steam sterilizer before they were allowed to go to their destination. The passengers were made to understand the importance of immediate resort to the nearest Government dispensary in the event of their suffering from painful swellings on their limbs or between their toes or under their toe nails.

In accordance with Government Notification No. 4617—4858-P., dated the 17th August 1898, and Notification No. 3893-P., dated the 14th June 1899, under the Epidemic Diseases Act and the Medical Inspection Rules framed under the Indian Ports Act, the examination of incoming vessels was imposed only on arrivals from plague, jigger, and cholera infected ports during the year. Vessels which had infectious disease dangerous to life at the time of arrival or during the voyage were also medically examined. The ports against which the inward inspection was imposed were Ulwa, Káthiáwár Coast, Karáchi, Persian Gulf Ports, Jeddah, Alexandria, Mauritius, Ports on the South-east Coast of Africa, Hong Kong and other Eastern Ports.

Owing to the outbreak of cholera in an epidemic form at Karáchi during the months of May, June, July and August 1899, all vessels from that port were carefully inspected on arrival with a view to prevent the importation of cholera into the City of Bombay. The vessels were thoroughly disinfected and the decks were scraped and afterwards washed with a five per cent. solution of carbolic acid or a solution of perchloride of mercury of the strength of 1 in 1,000. The bilge water was pumped out and a fresh

supply of drinking water was stored on board. Vessels trading between Bombay and Karáchi were recommended not to take on board at Karáchi any drinking water.

The following table shows the total number of vessels, crew and passengers examined on arrival at Bombay from the above-mentioned ports.

Months.	Number of Vessels inspected.			Number of Persons inspected.							Number of Persons segregated.			Number of Plague cases found on arrival at Bombay.
				Passengers.		Crew.		Total.						
	Number of Steam-ship and Square-Rigged Vessels.	Number of Native Sailing Craft inspected.	Total.	Steam-ship and Square-Rigged Vessels.	Country Craft.	Steam-ships and Square-Rigged Vessels.	Country Craft.	Number of Passengers.	Number of Crew.	Number of Crew and Passengers.	Passengers.	Crew.	Number of Crew and Passengers.	
1899.														
January	69	304	373	11,399	1,214	3,675	1,028	12,643	4,703	17,346	23	3	26	—
February	62	344	406	8,556	1,208	3,100	1,012	9,764	4,112	13,876	11	—	11	—
March	33	141	174	6,089	529	2,202	479	6,618	2,681	9,299	15	—	15	1
April	19	—	19	708	—	2,123	—	708	2,123	2,831	5	—	5	2
May	16	—	16	1,386	—	1,306	—	1,386	1,306	2,692	38	2	40	1
June	33	—	33	1,602	—	2,653	—	1,602	2,653	4,255	19	3	22	—
July	40	—	40	1,244	—	3,314	—	1,244	3,314	4,558	27	1	28	—
August	37	—	37	1,733	—	2,915	—	1,733	2,915	4,648	24	1	25	—
September	23	2	25	1,905	12	1,930	21	1,917	1,981	3,898	21	—	21	—
October	17	6	23	2,943	36	1,969	199	2,979	2,168	5,147	12	—	12	—
November	19	5	24	2,859	8	1,654	90	2,867	1,744	4,611	6	—	6	—
December	23	5	28	1,399	—	2,233	117	1,399	2,350	3,749	27	—	27	—
Total ..	391	807	1,198	41,823	3,037	29,104	2,946	44,860	32,050	76,910	228	10	238	4

The above table includes the number of ships which brought returning pilgrims from Jeddah.

III.—Outward Vessels.

The following table shows the number of outward bound vessels and their passengers and crew inspected month by month from 1st January to 31st December 1899.

Months.	Number of Vessels inspected.			Number of Persons inspected.							Number of Persons rejected.			Number of Plague cases which developed among the rejection.
				Passengers.		Crew.		Total.						
	Number of Steam-ship and Square-Rigged Vessels inspected.	Number of Native Sailing Craft inspected.	Total.	Steam-ships and Square-Rigged Vessels.	Country Craft.	Steam-ships and Square-Rigged Vessels.	Country Craft.	Number of Passengers.	Number of Crew.	Number of Crew and Passengers.	Passengers.	Crew.	Total Passengers and Crew rejected.	
1899.														
January	268	6,328	6,596	55,100	9,504	13,197	40,474	64,604	53,671	118,275	1,708	87	1,795	20
February	245	6,365	6,610	57,678	9,653	12,973	40,619	67,331	53,592	120,923	3,089	146	3,325	34
March	255	6,865	7,120	67,191	7,690	13,048	43,679	74,881	56,727	131,608	2,910	157	3,067	33
April	255	6,464	6,719	37,771	4,920	13,150	41,036	42,691	54,186	96,877	762	124	886	10
May	262	7,283	7,545	45,260	6,809	12,322	46,537	52,069	58,859	110,928	1,487	134	1,621	4
June	166	2,159	2,325	20,446	1,838	9,247	12,604	22,284	21,851	44,135	545	90	635	1
July	192	1,270	1,462	13,680	831	9,292	9,514	14,511	18,776	33,287	249	65	314	—
August	250	2,485	2,735	15,361	1,629	10,138	16,861	16,990	26,999	43,989	426	89	515	1
September	230	3,989	4,219	34,704	4,772	13,255	28,863	39,476	42,118	81,594	871	105	976	5
October	252	6,404	6,656	50,824	5,293	13,987	41,165	56,117	55,152	111,269	1,417	135	1,552	1
November	261	5,795	6,056	46,959	4,193	14,359	37,512	51,152	52,371	103,523	896	122	1,018	—
December	255	6,296	6,551	58,238	5,805	13,672	42,306	64,043	55,978	120,021	1,655	155	1,810	8
Total ..	2,891	61,703	64,594	503,212	62,937	149,110	401,170	566,149	550,280	1,116,429	16,015	1,409	17,424	117

In accordance with the Medical Inspection Rules prescribed in General Department (Plague) Notification No. 4616—4857-P., dated the 17th August 1898, and Notification No. 3892-P., dated the 14th June 1899, the medical examination of the crew and passengers of all vessels, including Native Sailing Craft which left Bombay for ports out of India was carried out by day *on shore* in sheds specially arranged for that purpose. Persons who embarked for vessels in the stream were examined at Madi Bandar or Ballard Pier while persons who embarked on vessels in the Docks were examined in the sheds alongside the vessel. There were also three centres in the harbour for the examination of the crews of the smaller Native Craft which run to the ports in close proximity to Bombay. As soon as the monsoon was over, another centre of examination was established at Warli and Máhím Bandars on the other or north-western side of the Island.

The result of the outward inspections for the year under report is given in the above table. It shows that out of 1,116,429 outward bound crew and passengers inspected, 17,424 or over 1½ per cent. were prevented from sailing. Many of them were suffering from fever and were turned into the town for a day or so until their temperature fell to normal. The remainder were sent to the Port Observation Camp, where 117 of them developed plague.

Out of the 64,594 outgoing vessels with 550,280 crew and 566,149 passengers examined during the year, 297 vessels left with 28,815 crew and 23,811 passengers for Aden, Red Sea and Europe ; 527 vessels with a total of 27,235 crew and 14,622 passengers for ports out of India other than Aden, Red Sea, and Europe, and the remaining 63,770 vessels with 494,230 crew and 527,716 passengers for Indian Ports including Burmah.

In addition to the medical examination of crew and passengers which was conducted by day on shore prior to their embarkation as directed by the Venice Sanitary Convention, the ship's company was again inspected on board before the issue of a Bill of Health immediately before departure from this port, This means that the crew of almost all vessels bound to ports out of India were examined three times, first when they were shipped, secondly when their kit was being disinfected, and thirdly immediately before the vessel sailed.

The form of Bill of Health issued to vessels sailing for foreign ports was the same as that prescribed by the Government of India in 1890, with certain additions and alterations made in it. The wording of the Bill of Health runs as follows. The additions made to the original form are in italic :—

Bill of Health.

"This is to Certify that the (steamer) ' ' sailing under the flag and under the command of Captain , of , tons bound for with a crew* of persons and passengers, and laden with a cargo of , is at the time of leaving this port in a satisfactory sanitary condition, and that no case of infectious disease dangerous to life exists among its officers, passengers or crew, *who have been examined by day on shore before embarkation and found free from plague.*

It is further certified that the Town and Port of Bombay are at present free from Epidemic Cholera, Yellow Fever, and all other dangerous Epidemic Diseases, *except plague which exists in an epidemic form.*

The clothing and bedding of the native crew and of the third class or deck passengers have been disinfected on shore."

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* Including Officers and able-bodied seamen.

During the year under report 2,891 steamers and square rigged vessels were examined. All of them were certified to have sailed from Bombay in a satisfactory sanitary condition. The Commanders and Agents have been very careful in paying attention to the sanitary state of their ships and in all cases they have cheerfully carried out the instructions and advice of the Port Health Officer. The forecastles were painted or limewashed before departure. Ships in ballast had their 'tween decks and holds cleaned before leaving the harbour, and in the case of coal ships the 'tween decks of which are used as latrines by the four or five hundred coolies who are employed in discharging the coals, were thoroughly washed down and in most cases limewashed or disinfected with a solution of carbolic acid. 61,703 Native Sailing Craft were inspected during the year. Their bilges were generally clean at the time of inspection. Those that were not clean had to pospone their departure until thoroughly cleaned.

Infectious Disease on Vessels in the Harbour.—The following table includes all steamers, square rigged vessels and Native Craft which became infected while at sea, or whose crew and passengers developed plague after arrival. It also shows the number of dock labourers or coolies who were removed to Plague Hospitals from the Docks and Bandars :—

Months.	STEAMERS.									BUGGALOWS, TONIES, PROWS, STEAM-LAUNCHES, &c.										Number of Persons who were attacked with Plague at Bandars and in the Docks.		TOTAL NUMBER OF CASES OF INFECTIOUS DISEASES IN THE BOMBAY HARBOUR.									
	Number of Ships.	Cholera		Small-pox.		Measles		Plague.		Number of Native Craft.	Cholera		Small-pox.		Measles		Plague.				Total number of infected Vessels.	Cholera		Small-pox.		Measles		Plague.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1899.																														
January ..	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	3	2	—	—	3	—	—	—	—	—	—	3	2
February ..	2	—	—	—	—	1	—	1	1	5	—	—	1	—	—	—	4	4	1	1	7	—	—	1	—	1	—	6	5
March ..	1	—	—	—	—	—	—	1	1	4	—	—	—	—	—	—	4	3	6	5	5	—	—	—	—	—	—	11	9
April ..	2	—	—	—	—	—	—	2	—	2	—	—	—	—	—	—	2	2	1	1	4	—	—	—	—	—	—	5	3
May ..	1	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—	2	2
June ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
July ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
August ..	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—
September	1	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	1
October ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	1	1
November	2	—	—	—	—	1	—	1	1	2	—	—	—	—	—	—	2	1	—	—	4	—	—	—	—	1	—	3	2
December ..	3	—	—	—	—	3	—	—	—	1	—	—	—	—	—	—	1	1	1	—	4	—	—	—	—	3	—	2	1
																			Total ..		30	1	1	1	—	5	—	34	26

All the above vessels including those in the table on page 187 were thoroughly disinfected in accordance with rules laid down in the Venice Sanitary Convention and those framed under the Indian Ports Act.

Port Observation Camp.—During the first two epidemics and up to the 15th January, 1899, some of the rejected persons from vessels were sent to the Plague Committee's Camps for observation and disposal. After the 15th January, 1899, the municipal authorities were unable to admit such people into their observation hospital at the Modikhana owing to want of accommodation. A part of the old Modikhana Camp was therefore taken over by Government from the municipal authorities and converted into an observation camp for harbour purposes. This camp was opened on the 16th January, 1899, with an establishment of one Hospital Assistant and one Ayah. One sweeper was also sanctioned but his services were not utilised, as arrangements were made with the Public Health Department of the Bombay Municipality for sweeping the camp. One of the Senior Medical Officers of the Port Health Staff was detailed from time to time to supervise the general working of the camp. Food was supplied to the destitute and sick people at the cost of Government.

The number of persons who developed plague among those segregated in the camp during the year was 121. Precautions were taken to have all the sheds thoroughly disinfected twice a week with the standard solutions of perchloride of mercury. As soon as a case of plague developed in a shed, the latter was at once disinfected with a solution of perchloride of mercury and was not used for some time after. Persons sent to the observation camp were kept until their temperature fell to normal or until it was certain that the fever from which they were suffering was not due to plague. Shortly after the camp was opened it was found that some persons were taking money from some of those placed under observation or from their friends on the promise that they would obtain immediate release from the camp. One man was detected, convicted and got six months' imprisonment.

Disinfection of Ships and General Health of the Shipping.—During the year 1899 the total number of infected vessels of all sorts, disinfected under the personal supervision of the Health Officer of the Port or of his staff, and assisted by the Water Police, was 62.

The Resident Transport Officer and the Senior Naval Officer arranged for carrying out the Port Health Officer's recommendations for the disinfection of transports on which cases of infectious diseases occurred.

The general health of the harbour population was fairly satisfactory. The various hospitals in the City admitted during the year 790 persons connected with the shipping. This number of admission is exclusive of plague. The Saint George's Hospital admitted 425 Europeans, of whom 13 died; the Jamsetji Jijibhoy 73 natives, of whom 7 died; and the Goculdas Tejpal 292 natives, of whom 18 died.

No deaths occurred from the effects of cleaning the bilges of ships during the year, but the Coroner of Bombay held 20 inquests on persons who died from accidents other than bilge-poisoning on board ships.

Red Sea Pilgrim Traffic.—Owing to the existence of plague in Bombay, the pilgrim traffic between the infected Indian Ports and Jeddah was stopped during the year 1899. Accordingly no vessels with Mecca pilgrims left this Port for Jeddah during the year. During the year 862 pilgrims returned by ship from Jeddah, *via* Aden and other routes. The baggage of all the returning pilgrims was disinfected at the Port Health Disinfecting Station. The pilgrims for up-country were not allowed into the town, but were sent direct from the ship to their homes by rail at the expense of Government.

Emigration Traffic.—The emigration traffic from Bombay was closed in the year 1897 and continued so up to date. Accordingly, no ship with emigrants sailed from this port, with the exception of three vessels ("Sultan," "Chindwara," and "Canara") with 28 emigrants. These emigrants were segregated for 10 days before they were allowed to depart.

Sanitary state of the Harbour and Foreshore.—Owing to pressure of work the usual inspection of the harbour and foreshore was not made during the year, and consequently no remarks are made on their sanitary conditions.

Plague.—Owing to the rigorous nature of the examination of crew and passengers and the disinfection of suspicious clothing and bedding, very few fully developed plague cases were found at the time of inspection. The people did not present themselves, if they considered they were in any way suspiciously ill, so as to avoid the risk of being detained. Special care was taken in recording temperatures, as many of the persons who developed plague had a temperature of under 100° F. at the time of rejection.

With a view to prevent the spread of plague to countries out of India, the Port Health Officer made proposals to the effect that (*a*) Commanders of vessels bound for ports out of India should ship their native crew as many days as possible, say seven days, before the time fixed for leaving the port, and (*b*) that Commanders be requested to take every reasonable precaution that their native crew did not enter the town. This could be done under the Epidemic Diseases Act. The proposals were made with a view to get the native crew for vessels out of, and keep them out of, the infected parts of the city. By doing this, they would in the first place escape many of the risks of contracting plague, and secondly, if they were in the incubation stage when shipped, the disease itself would be fully developed before the vessel left the port. These proposals were forwarded to the Chamber of Commerce for their opinion. The Committee of the Chamber expressed an opinion that the proposal to keep crews on board their ships for some days before sailing was impracticable. The system followed by ships with native crews is that on arrival in port the crew is paid off, and the same crew is customarily signed on again just before sailing. The Committee further submitted that if it be indispensable that lascars should be protected from contagion, Hogg Island or some equally isolated place, ought to be utilized as a depôt from which drafts of seamen could be made to ships. In conclusion they stated that the enquiries instituted tend to show that the existing regulations under the Venice Convention are in themselves all that can be practically desired, and that every effort is made by Agents and Commanders to secure a faithful observance of those regulations. After the careful consideration of the proposals, Government passed an opinion that the thorough and strict medical examination now enforced, coupled with the disinfection of clothing and kit, is showing itself to be a very effectual safeguard, and till examination and disinfection prove ineffectual the principles of the Venice Convention had better be adhered to.

The rigorous and very searching examination enforced on each individual who departed from this port, the thorough disinfection of suspicious clothing, bedding and boxes of those who left for ports out of India and the rejection of all persons who showed any suspicious signs or symptoms show a satisfactory result by the almost complete absence of genuine plague cases on the hundreds of ocean-going steamers which left Bombay during the year under report.

The following ocean-going vessels were reported to have had plague on board after leaving Bombay.

(*a*) On the 18th of January, 1899, the S.S. "Booldana" left the Port of Bombay for Rangoon, and was reported to have conveyed out of this port a case of plague. This was a native crew. At the time of the inspection of the vessel one of the saloon crew, a native cook, was missing. It turned out that the missing cook was at the time suffering from fever on shore, and did not like to face the inspection. He died of plague on shore a few days after the vessel sailed. The man, who developed plague on board after leaving the port, was another native cook who was found to have resided in the same house as that in which the first cook died from plague. This cook who developed plague on board was therefore a "contact."

(*b*) A "suspicious" case of plague was reported to have got away from Bombay in a vessel bound for Aden. This was on the S.S. "Caledonia" (running between Bombay and Aden), which left Bombay on 1st April, 1899, and arrived at Aden on the 6th idem. A man named A. Dias, a Portuguese Scullian, was found suffering from fever and enlarged glands on the 7th, and was landed in accordance with the standing order of the Company. The man was said to be suffering from Pestis Minor by the Aden authorities, and on the day the vessel left Aden, *viz.*, 10th April, 1899, on her return voyage to Bombay, the man's temperature had fallen. The man's name was entered by us in the official Log Book before the vessel left Bombay, certifying that he was suffering from chronic enlarged glands, so that in the event of his suffering from fever in a foreign port the captain may be able to produce it to show that the glands from which he was suffering were not due to plague. The Log Book was not produced when the man was landed from the vessel.

(*c*) The S.S. "Peninsular," which left Bombay for Aden and London on 23rd September, 1899, is said to have landed at Plymouth a lascar who had suffered from plague during the voyage, and was in a state of recovery at the time of his arrival at Plymouth. It has been stated by the Port Medical Officer, Plymouth, that on 21st October, 1899, he made an incision into the bubo and obtained a pipette of blood and serum, which was submitted to Dr. Klein for examination, with a negative result.

(*d*) The Civil Surgeon, Muscat, reported the detection of an imported case of plague on the 13th April, 1899, in the town of Muscat, from Bombay. The man, who is said to have had plague in Muscat 16 days after arrival, arrived in Bombay from East Africa in the S.S. "Sultan" on the 8th March, 1899, and embarked on the S.S. "Pachumba" on the 23rd March for the Persian Gulf *viâ* Karáchi. There is nothing to show that he had fever or a bubo of any kind when he left Bombay, or when he arrived at, or left, Karáchi. According to the Civil Surgeon at Muscat the man is said to have developed a bubo on the 28th March, the day before he arrived at Muscat, and although he was placed in quarantine on arrival, the bubo was not discovered until the 13th April; that is, 16 days after arrival, or 21 days after leaving Bombay. The man was alive, and the diagnosis of plague was not confirmed by a bacteriological examination.

(*e*) The *Pall Mall Gazette* of 25th July, 1899, announced that an outbreak of plague occurred on board the S.S. "Dictator," bound for Liverpool, and laden with grain from Bombay and Karáchi. The S.S. "Dictator" left Bombay in water ballast for Karáchi on the 14th June, 1899. She carried a crew of 14 Europeans and 49 Natives. All the Natives' clothes, bedding and boxes were disinfected before being allowed on board. The vessel carried no passengers. The "Dictator" arrived at Karáchi all well on the 16th June, 1899, and remained there for nine clear days, during which time she took on board a cargo of wheat, and shipped one Native as a fireman. On the "Dictator's" arrival at Perim on the 4th July, 1899, a sick Native was shown to the Port Surgeon, who found him suffering from an enlarged gland in the right groin, and a temperature of 101° F. These were said to be due to the man having fallen off a ladder. The Port Surgeon left the sick man on board, gave the captain certain instructions, and informed the Suez authorities. It was stated by the President of the Quarantine Board in Egypt that when the "Dictator" arrived at Suez on the 9th July, 1899, she had two cases of plague and three suspects on board. A bacteriological examination was made after arrival at Suez, but no plague microbes were found in the man said to be suffering from plague.

The last two cases—"Pachumba" and "Dictator"—should not be counted against Bombay, because, although the vessels left this port they had been to another Indian plague port afterwards, and were passed in by the authorities at that port as free from plague. They are simply inserted here as they were ocean-going steamers which had Bombay as their port of departure. The "Caledonia" and "Peninsular" were doubtful cases, as both recovered, and the diagnosis was not confirmed by the bacteriological examination which was made. This leaves only one genuine case, viz., that on the Booldana" at Rangoon, which developed plague after leaving this port during the year 1899. Besides the above-mentioned ships it is only reasonable to suppose that some of the coasting vessels must have conveyed plague cases to Karáchi, and the small ports north and south of Bombay; but on the whole they must have been comparatively very few, more especially when the large passenger traffic which exists between these ports is taken into consideration. The coast ports south of Bombay to which the majority of the local passengers go are free from plague. Karáchi and Cutch-Mandvi are the only ports on the coast north of Bombay which are infected, and the disease is said not to have left them since the first outbreak in 1896.

Whenever any of the crew or passengers, who were prevented from sailing on a vessel bound for a foreign port developed plague, the fact was communicated to Government with a view to telegraphic intimation being given to the authorities at the first port of call. In cases where plague occurred among persons prevented from sailing on vessels bound to an Indian port, the fact was notified by the Port Health Officer to the next port at which the vessel was due to call.

During the year 117 cases of plague were prevented from proceeding on vessels leaving the port; 34 cases were found on vessels and native craft in the harbour, and at the docks and bandars, and four were found on vessels coming from infected ports close to Bombay, making a total of 155 plague cases.

Towards the end of the year 1898 the Indian Plague Commission was appointed. The members inspected the work of the Port Health Staff, and took evidence on the measures adopted at this port for the prevention of the spread of plague by sea. Their report has not yet been issued, but at the time of their inspection they expressed themselves as being thoroughly satisfied with what was being done to prevent the spread of plague to foreign countries.

Unfortunately plague has broken out at foreign ports, but so far no country or port can point to Bombay as being the cause of the plague from which they are suffering; at least, in no case can outbreaks at foreign ports be traced to the crew or passengers from Bombay. The question of infection by rats and cargo has not been touched on, as presumably the subject will be fully dealt with in the report of the Indian Plague Commission.

It is probable that plague of a mild type has been and is widely distributed in the East, and when at times it broke out as a mild epidemic, the high mortality was attributed to an unhealthy season or year. At present every one is on the look out for plague with the result that the true cause of the high mortality which occurrs from time to time is recognised as being due to plague. I may mention that plague is endemic on the Arabian Coast of the Red Sea between Leith and Lohea, and that, owing to the recurrent epidemics in October 1893, July 1894, August 1895 and October 1896, quarantine was imposed at Suez and Aden against arrivals from the infected part of the Arabian Coast.

The majority of plague cases in the East contract the disease by inoculation through cracks, fissures or ulcers on the feet as the large majority of the population go barefoot. It is, therefore, probable that so long as plague in the East is confined to the bubonic type the people at European ports and at other ports where the population wear boots and shoes, will not suffer from the disease in an epidemic form.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1899-1900.

(*W. R. Bright, Esq., Chairman of the Corporation.*)

Town and Bustee Improvement.—The total expenditure on account of town and bustee improvements during the year 1899–1900 was £5,626 against £6,642 in the previous year.

Water Works: Filtered System.—The average daily consumption of water for the year under report amounted to 20,681,822 gallons as compared with 20,684,393 gallons in 1898–99. 1,337 feet of 4-inch pipes with 2-4 inch sluice-valves and 725 feet of 3-inch pipes with one 3-inch sluce-valve were laid in Penn Estate and Little Rawdon Street respectively. For the improvement of water-supply in Hastings the existing small pipes in the streets of the village of Hastings have been taken up to a length of 5,125 feet, and replaced by 6,729 feet of new pipes of larger size. Besides, the above six standposts have been fixed—four in town area and two in added area. The total mileage on the 31st March, 1900 was 315·16 miles. The number of premises connected during the year amounted to 610, or the total number on the 31st March, 1900, 28,953.

The consumption of filtered water per head of population per day was 33·68 gallons in the town area and 20·89 gallons in the south added area.

Unfiltered Water Supply System.—The average quantity of unfiltered water supplied daily was 9,687,493 gallons as compared with 4,778,899 gallons in 1898-99, and the consumption per head of population per day was 17·52 gallons in town area and 3·69 gallons in south added area.

The number of premises connected for flushing, &c., purposes and street-adjuncts in connection with the unfiltered water supply system on the 31st March, 1900, are 2,835 premises, 121 public conveniences, 2 bathing-platforms, 345 sewer-flushings, and 5,650 ground-hydrants. 63,526 lineal feet, or 12·03 miles of pipes, have been laid, and 607 ground-hydrants for piping sewered roads in town area. Besides the above, 2,789 feet of 14-inch and 639 feet of 12-inch pipes were laid, and one 14-inch and four 4-inch sluice-valves and 33 ground-hydrants were fixed departmentally in connection with the supply of unfiltered water to Palmer's Bridge Pumping Station and High-Level-Sewer.

The total length of unfiltered water pipe laid in the south added area now totals 191,307 feet, or 37·55 miles. Water is daily pumped into the district and is used for road-watering purposes. The unfiltered water will now be used in place of filtered water for the watering of gardens, &c., wherever possible.

Drainage and General Construction.—During the year 4·09 miles of pipe-sewers were entirely re-constructed to new specification, ·27 mile of surface drain was constructed and ·91 mile of kerb and channel stones was laid in public streets and 1·5 miles of brick sewers were repaired, 30 sewer man-holes, 13 sewer lamp-holes, 18 gully-pits and 37 flushing-chambors fitted with automatic flushing syphons were constructed. The sewer, including 9·46 miles of bustee sewers, now measure 200·680 miles.

Of works of public convenience 14 double-seated Bombay pattern urinals with "Finnimore" patent seats have been erected and brought into use, five old bathing-platforms, four night-soil depôts, one methers' barrack and one urinal have been thoroughly repaired. One new bathing-platform is under construction.

Three hundred and thirty-one thousand two hundred tons of refuse were conveyed by the municipal railway to the square mile and unloaded, as compared with 308,110 tons in the previous year. In addition to this, 16,913½ tons of road metal and building materials were hauled from the store depôt at Baugbazar and unloaded at the various sub-depôts in Circular Road.

House Drainage.—The number of premises connected with the public sewer during the year was 502, bringing the total up to 30,670. The drains of 6,096 premises were inspected during the year, and out of this number 1,695, or 27·8 per cent. were found more or less defective, and notices to rectify, specifying the defects were issued in all cases ; 7,535 re-inspections were also made.

Sanction was accorded to the connection of 789 privies with the public sewers.

Health of the Town.—The year under review has been a specially unhealthy one, the death-rate being the highest recorded during the past 10 years except 1895. The mortality from dysentery and diarrhœa was higher than that of every year since 1889 ; and though the mortality registered under the head of fever was lower than that of the previous eight years excepting 1898, the fall was more apparent than real, as in consequence of the presence of plague in the town cases of fever were often registered under other causes, and the mortality registered under causes other than small-pox, cholera, bowel-complaints, fever and plague, was the highest recorded during the past 10 years. Deaths from cholera and small-pox, however, were fewer than the average of the past 10 years. The birth-rate, though showing a considerable increase over the previous year, was still lower than the average.

A sketch is given in the Health Officer's Report of the presence of larval and pupal forms of mosquitos of the anopheles type, which are thought to form a link in the transmission of malaria from man to man, in a large number of the tanks and *dobas* in Calcutta, and of the experimental measures taken for their destruction.

The number of vaccinations during the year was 16,011 against 13,255 in the previous year. The Health Officer's scheme for the re-organisation of the Vaccination Department of the town was sanctioned during the year, but owing to the inadequacy of the grant for the purpose, and other causes, the scheme could only be partially carried out.

Samples of the filtered water supplied to the city were analysed, as well as samples of river water and water drawn from settling tanks at Pulta. The results were satisfactory though there was a rise in the temporary hardness of the filtered water. Samples of water from foul tanks and wells, as well as of milk, *ghee* and other articles of food were also analysed, and the illuminating gas supplied to the city was periodically examined. A fair amount of bacteriological work was also done.

Rice and *dal*, the common food of the poor, were cheaper than last year.

Articles of food and drugs were inspected, and over 2,735 maunds of grains, vegetables, etc., were condemed as unwholesome and destroyed. Over 105 maunds of meat found unwholesome at the municipal slaughter-house were likewise destroyed.

The number of animals slaughtered rose from 151,494 in 1898–99 to 169,993 during the year under review.

In the municipal gowkhanas the mortality of animals exceeded that of last year. There were 617 deaths, of which 209 were due to rinderpest, 207 to general debility and 98 to glanders and farcy. The Health Officer has made proposals for reducing the mortality which are engaging the attention of the Commissioners.

Thirty-two thousand nine hundred and thirty-three waggon-loads of refuse, etc., were removed from the town and a part of the suburbs and sent to the Square-mile. This figure is the highest yet recorded. The rest of the refuse in the suburbs was collected and otherwise disposed of.

Twenty new waggons for the removal of refuse have been sanctioned, and the number of inspectors to supervise waggon-loading work has been raised from one to five.

The number of tanks filled up during the year was less than in the previous year (40 against 45), but the number of prosecutions in the owners of insanitary tanks was much larger (282 against 32).

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1899.

(*Dr. J. Nield Cook.*)

Except for plague, which persisted with a low degree of epidemicity throughout nearly the whole year, the health of Calcutta was comparatively good, the deaths registered under all the special causes, cholera, diarrhœa and dysentery, small-pox and fevers being 1,852 below the average of the previous ten years. The excess above the normal mortality may therefore be directly attributed to plague, and this is graphically shown in the chart at the beginning of the report, in which the plague mortality and the general mortality are represented together. Plague was under a separate department consisting of Major H. E. Deane, R.A.M.C., and a number of European and other Medical Officers who had a separate Office, and worked independently of the Health Department, so as I took no part in its administration I am unable to report on it. The system of having separate staffs and disinfecting establishments for different epidemic diseases besides being costly has decided drawbacks, for many letters giving information about plague cases are addressed to the Health Officer, and time is lost in transferring them ; many of these letters deal partly with plague and partly with sanitary matters and in cases which are wrongly reported in the first instance two inquiries have to be made—one by the plague officers and the other by the medical officers of the Health Department.

The comparative mortality ratios for different parts of the town are not reliable as the populations of the wards given in the census of 1891 are very far from being correct. It is hoped that next year, when the new census figures should be available, it will be possible to make more accurate statements and reliable deductions, though so long as no death certificate of any kind is required and our information of the causes of death depends upon the statements of illiterate persons interpreted by Registrars with only a modicum of education our information as regards the mortality from special diseases must be practically useless.

Meteorological Conditions.—There was no marked variations from the normal in the meteorological conditions, which do not appear to have exercised more than a general seasonal influence on the health of the town. In the first quarter the mean temperature averaged 71·8° F. against 73·5° F. the rainfall was 2·35 inches below the average, humidity slightly above and barometric pressure slightly below. In the second quarter the mean temperature was half a degree below normal, the rainfall 9·06 inches above the average, the heaviest fall occuring in June, the humidity was 4·6° above and the barometric pressures slightly above normal. In the third quarter the temperature was practically normal, the rainfall 2·35 inches above the average, the heaviest fall occurring in July, namely, 21·47 inches, the rainfall during the remainder of the quarter being below the average, and the humidity and barometric pressure were slightly above normal. In the fourth quarter the temperature was well below the normal, especially in November and December, averaging 71·6° F. against 76·1° F., the rainfall was below normal, being 3·04 inches against 6·5, the humidity averaged 4° above normal, and the barometric pressure was slightly above normal.

Price of Food.—Butcher's meat was on the whole cheaper than it has been in previous years, ghee was the same price, and rice and dhal were cheaper, firewood being dearer. Common rice, the best index of the food of the poor, sold for from As. 2-0 per seer, the average price being As. 2-6 to As. 2-9., a very appreciable reduction.

Vital Statistics: Births.—The total number of births registered in Calcutta was 11,004 giving a birth-rate of 16·1 against 9,530 and 13·9 in the previous year. The low birth-rates in Calcutta are ascribed to the population being to a considerable extent a floating one, and to the female population being comparatively small. The proportion of male to female births was 108 to 100. The Christian population was the most prolific with a birth-rate of 20·7 per 1,000 of the population, the Hindus coming next with 16·7 and the Mahomedans last with 13·6.

The number of still-births was 933 against 729 in the preceding year, being 84·7 per 1,000 live births. This figure is so high that I can only suppose that numbers of deaths are entered under this head that should rightly come under infantile mortality.

General Mortality.—The number of deaths was 25,823, against 23,343 in the preceding year, giving a death-rate of 37·8 against 29·8, the average of the previous five years being

31·9. The excess above the average number of deaths may be attributed to plague which accounted for 2,332 according to the reports made by the plague officers which number would appear to be below the actual as the number of deaths registered under most of the special heads, such as cholera, small-pox and fevers was appreciably below the average. The mortality varied from 14·7 in Waterloo Street to 47·5 in Burtollah, which had also the highest birth-rate. The mortality in the suburbs was higher than in the town. Particulars of the different wards are given in the statement below.

According to Age.—The mortality was higher under every age period than in the previous year. The mortality under 10 years was higher in the town than in suburbs, but over 10 and under 60 it was higher in the suburbs than in the town.

The deaths of infants under one year of age numbered 4,037, giving a ratio of 366·8 to every 1,000 children born during the year against 368·5 in the previous year. The Mahomedan ratio 504·3 was the highest, though lower than the previous year. Excluding "other classes" the Hindu ratio 334·7 was the next highest, whilst the Christian returns give the comparatively low figure 174·4. As, generally speaking, there is not much to choose between the conditions of life of Mahomedans, Hindus and Christians in Calcutta, it is evident that there is a very considerable infant mortality amongst the two former classes that might be prevented by better care of the infants, apart from the influence of bad sanitation, which affects all classes equally. It is probable that there is some connection between the marriage customs of the classes and their infantile mortality, as when an immature woman marries she frequently bears one or two weakly children.

The incidence of mortality was far heavier amongst females (45·6) than amongst males (33·8) at all ages over one year, and this was due to the heavy female mortality in the town as distinguished from the suburbs. There is nothing to show whether this mortality fell heavier on the *purdah* women or the cooley classes, and excepting marriage and child-bearing, which do not affect the earlier ages it is not apparent why the female mortality in the town is so much heavier than the male. It may be that the female population is underestimated, in which case the heavier incidence of mortality amongst the females would be apparent rather than real. The new census will perhaps clear up this point: at present there are many reasons for doubting that the populations we are working with are even approximately correct.

If "other classes" of which the members are comparatively small be excluded, the Hindus had the highest mortality (38·8), and the Christians the lowest (24·9).

The following statement shows that the mortality was above the average of the previous five years in all the wards of the town and suburbs except Waterloo Street and Bamun in the former, and Sukea's Street, Tallygunge and Ballygunge in the latter. Cholera was worst in the Added Area, Shampuker and Bhowanipur in the suburbs, plague in Burtollah, Jorabagan, Jorasanko and Burra Bazar; fevers in Hastings and Entally; and dysentery and diarrhœa in the Added Area, Burtollah, Sukea's Street, and Moochipara, and in Entally and Kidderpore. The total registered mortality from cholera, small-pox and fevers was however below the mean in both the town and suburbs, that from dysentery and diarrhœa being above the mean in both.

Statement of Deaths from different causes during 1899.

1.	2.	3.	4.	5.	6.	7.	8.	9. Injury.					10.	11.	12. Ratio of Deaths per 1,000 of Population.								
								Suicide.													*From all Causes.*	
No. of Wards.	Names of Wards.	Population according to Census of 1891.	Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Plague.	Male.	Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	All other Causes.	Total Deaths from all Causes.	Cholera.	Small-pox.	Plague.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes.	For the Year.	Mean of previous Five Years.
1	Shampooker	29,951	57	—	304	141	140	5	3	11	—	19	536	1,197	1·9	—	4.6	10·1	4·6	·63	17·8	39·9	33·9
2	Coomartolly	26,614	64	1	323	145	108	2	2	4	—	8	371	1,020	2·4	·03	4·0	12·3	5·4	·30	13·9	38·3	34·3
3	Burtollah	28,374	46	1	319	130	163	4	2	13	—	19	490	1,168	1·6	·03	5·7	11·2	4·5	.66	17·2	41·1	36·8
4	Sukea's Street..	25,750	29	—	243	110	82	1	1	7	—	9	429	902	1·1	—	3·1	9·4	4·2	·35	16·2	35·0	31·6
5	Jorabagan	39,180	83	1	581	188	251	7	6	14	—	27	549	1,680	2·1	·02	6·4	14·8	4·7	·68	14·0	42·8	33·5
	Mayo Hospital	—	13	—	3	4	1	—	—	2	—	2	17	40	—	—	—	—	—	—	—	—	—
6	Jorasanko	41,657	61	1	467	210	234	4	7	16	—	27	741	1,741	1·4	·02	5·6	11·2	5·0	·64	17·7	41·8	38·2
7	Burra Bazar	20,646	35	1	309	82	125	—	1	6	—	7	243	802	1·6	·04	6·0	14·9	3·9	·34	11·7	38·6	31·5

Statement of Deaths from different causes during 1899—continued.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1891.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Plague.	9. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Plague.	Fever.	Dysentery and Diarrhœa.	Injury.	All other Causes	From all Causes. For the Year.	Mean of previous Five Years.
8	Colootollah	50,781	65	9	458	186	138	3	2	18	—	23	821	1,709	1·2	·17	2·7	9·0	3·6	·45	16·1	33·4	30·6
	Medical College Hospital ..	—	6	—	5	22	16	1	3	12	—	16	137	202	—	—	—	—	—	—	—	—	—
9	Moocheepara	39,109	32	4	435	152	124	1	2	10	—	13	747	1,507	·81	·10	3·1	11·1	3·8	·33	19·1	38·5	34·8
	Police Hospital	—	—	—	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—	—	—	—	—
10	Bow Bazar	22,668	21	—	214	87	50	2	—	13	—	15	366	758	·92	—	2·2	8·9	3·8	·66	16·1	33·2	32·2
11	Puddopooker	20,761	36	4	190	89	61	2	1	6	—	9	333	722	1·7	·19	2·9	9·1	4·2	·43	16·0	34·7	33·4
12	Waterloo Street	6,083	7	1	17	12	15	—	1	6	—	7	31	90	1·1	·16	2·4	2·7	1·9	1·1	5·0	14·7	15·3
13	Fenwick Bazar	28,366	25	2	256	88	79	1	1	7	—	9	334	793	·88	·07	2·7	9·0	3·1	·31	11·7	27·9	22·6
14	Taltollah	29,207	14	1	264	108	54	2	1	8	—	11	531	983	·47	·03	1·8	9·0	3·7	·37	18·1	33·6	31·2
15	Collinga..	13,218	3	1	153	67	25	—	—	4	—	4	252	505	·22	·07	1·8	11·5	5·0	·30	19·0	38·2	30·6
16	Park Street..	4,620	—	—	25	12	9	—	—	2	—	2	40	88	—	—	1·9	5·4	2·6	·43	8·6	19·0	14·3
17	Bamun Bustee	4,598	2	—	33	10	4	—	—	1	—	1	62	112	.43	—	·87	7·1	2·1	·31	13·4	24·3	48·3
18	Hastings	4,820	6	—	73	16	4	—	—	2	—	2	87	188	1·2	—	·83	15·1	3·3	·41	18·0	39·0	38·2
	Military Hospital	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	436,403	605	27	4,672	1,859	1,683	35	33	162	—	230	7,120	16,196	1·3	·06	3·8	10·6	4·2	·52	16·3	37·1	32·8
	Fort William	3,468	—	—	34	7	—	1	—	1	—	2	10	53	—	—	—	9·8	2·1	·57	2·8	15·2	7·6
	Port of Calcutta	26,589	43	—	30	8	—	—	—	28	—	28	19	128	1·6	—	—	1·1	·30	1·0	·76	4·8	5·3
	Grand Total ..	466,460	648	27	4,736	1,874	1,683	36	33	191	—	260	7,149	16,377	1·3	·05	3·6	10·1	4·0	·55	15·3	35·1	30·4
	SUBURBS.																						
1	Added Area, Shampooker..	6,934	23	—	97	20	29	—	—	3	—	5	105	279	3·3	—	4·1	13·9	2·8	·72	15·1	40·2	39·3
3	Do. Burtollah ..	8,057	5	—	88	56	47	2	1	4	—	7	181	384	·62	—	5·8	10·9	6·9	·88	22·4	47·6	41·5
4	Do. Sukea's Street	9,078	8	—	105	54	22	—	2	3	—	5	196	390	·88	—	2·4	11·5	5·9	·55	21·5	42·9	43·2
9	Do. Moocheepara	10,363	6	1	105	65	31	1	1	6	—	8	226	442	·57	·09	2·9	10·1	6·2	·77	21·8	42·6	31·8
19	Entally	33,147	44	5	488	208	68	2	1	18	—	21	595	1,429	1·3	·15	2·0	14·7	6·2	·63	17·9	43·1	38·3
	Campbell Hospital	—	15	3	89	371	2	—	—	8	—	8	311	799	—	—	—	—	—	—	—	—	—
20	Baniapooker	23,020	8	—	318	110	20	—	—	8	1	9	434	899	·34	—	·86	13·8	4·7	·36	18·8	39·0	34·5
21	Ballygunge and Tallygunge	22,831	19	—	236	122	37	—	—	6	—	6	389	809	·83	—	1·6	10·3	5·3	·26	17·0	35·4	41·8
22	Bhowanipur	42,591	118	—	397	241	235	3	2	9	—	14	716	1,721	2·7	—	5·5	9·3	5·6	·32	16·8	40·4	39·6
	General Hospital	—	6	—	5	3	—	1	—	—	—	1	26	41	—	—	—	—	—	—	—	—	—
	Shumbu Nath Hospital ..	—	1	—	3	9	—	—	—	5	—	5	10	28	—	—	—	—	—	—	—	—	—
	European Lunatic Asylum	—	—	—	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—	—	—	—	—
	Alipur Lock Hospital ..	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
	Do. Jail Hospital ..	—	—	—	—	3	—	—	—	1	5	6	29	38	—	—	—	—	—	—	—	—	—
	Do. Police Hospital ..	—	—	—	1	2	—	—	—	—	—	—	9	12	—	—	—	—	—	—	—	—	—
	Do. Police Case Hospital	—	—	—	—	—	—	2	1	1	—	4	—	4	—	—	—	—	—	—	—	—	—
23	Alipur	14,804	35	—	111	69	22	1	1	4	—	6	177	420	2·3	—	1·4	7·4	4·6	·40	11·9	28·3	27·3
24	Khidderpur and Ekbalpur	15,340	4	1	144	104	46	1	—	10	1	12	418	729	·26	·06	2·9	9·3	6·7	·77	27·2	47·5	37·6
25	Watgunge and Garden Reach	26,833	44	25	242	141	90	1	1	21	—	23	438	1,003	1·6	·93	3·3	9·0	5·3	·85	16·3	37·3	31·3
	Total	212,998	336	35	2,429	1,579	649	14	10	109	7	140	4,263	9,431	1·5	·16	3·0	11·4	7·4	·65	20·0	44·2	41·7
	Canal	2,102	6	—	8	—	—	—	—	—	—	—	1	15	2·8	—	—	3·8	—	—	·47	7·1	12·1
	Grand Total ..	215,100	342	35	2,437	1,579	649	14	10	109	7	140	4,264	9,446	1·5	·16	3·0	11·3	7·3	·65	19·8	43·9	41·5
	Combined Total ..	681,560	990	62	7,173	3,453	2,332	50	43	300	7	400	11,413	25,823	1·4	·09	3·4	10·5	5·0	·57	16·6	37·8	31·9

Special Causes of Mortality: Fevers.—The total mortality registered under this head in the town and suburbs combined was 7,173, against 6,060 in the previous year, and 8,189 the average of the decade. The comparative incidence in different parts of the town is shown in shades of colour on the map at the beginning of the report. Though the registered mortality from fevers was below the average, I believe that this does not truly represent the fever mortality for the year; for the deaths registered under other causes were 3,223 above the average, and I have shown in the previous report that with the advent of plague the deaths registered under fevers fell appreciably, whilst there was a corresponding rise in deaths registered under "other causes." Moreover, the surgeon to the police, the officers of the native regiment, private practitioners, and natives who knew the town well, all assured me that fevers were unusually prevalent and severe in type. The largest number of deaths registered as fevers occurred between the middle of February and the middle of April, a very dry and hot season when malarial fevers would not be expected to be especially prevalent. But as the heaviest plague mortality occurred about this time, it appears probable that a number of plague deaths were registered as fever, though as I have already stated many of the ordinary fever deaths were registered under "other causes" to avoid the suspicion of their being due to plague. But the registration of the causes of death in Calcutta is so unreliable that it is difficult, if not impossible, to draw reliable inferences from the statistics, especially as I have strong grounds for believing that the census figures of 1891 are far from being a true index of the relative population of different parts of the town at the present time.

Mosquitoes and Malaria.—Being convinced that mosquitoes of the anopheles type form a link in the transmission of malaria from man to man, though the exact nature of the connection may not yet be fully understood, it seemed to me that the time had come to give practical effect to what have hitherto been more or less theoretical considerations, and try whether anything could be done to reduce the very heavy mortality from fevers, which appears with but little variation in the death returns of Calcutta, and that, if my efforts in this direction were to meet with any measure of success, this would in itself be the strongest confirmation of the truth and value to scientific medicine of the mosquito theory. Accordingly, in 1899 I applied to the Commissioners for permission to employ Mahomed Bux (who as peon to Major Ronald Ross used to hunt for anopheles mosquitoes for his work when he was in Calcutta) on Rs. 16 per mensen, and an assistant on Rs. 8 to hunt out the places where these mosquitoes bred within the area of the municipality, and, if possible, to kill them in the larval or pupal stage of their existence. The Commissioners sanctioned the project for one year in January, 1900, with the condition that the total expenditure should not exceed Rs. 30, or £2, a month, and Mahomed Bux took up his appointment on the 15th February, 1900. The first thing to be done was to ascertain the breeding-grounds of the anopheles mosquito. The practice adopted was for Mahomed Bux and his assistant to do the hunting and bring specimens, and for the Assistant Health Officer, Dr. Sen, and myself to verify his results, and mark the places on a map with a short note. Up to the time of writing, three months from the commencement of work, we have found 89 such places. I had intended to send Mahomed Bux round with my Sanitary Inspectors, so that they might all learn how to recognise anopheles larva, and be able to report the places where it was found, but owing to the prevalence of plague, cholera, and small-pox, their work was exceptionally heavy, and I thought it better not to employ them on work that might take them away from their more legitimate duties. The survey was made during the driest and hottest part of the year, when mosquitoes die off very quickly, if they are bred artificially, so that it is probable that the number of breeding-places which we found is much less than it would be during the rains, and owing to the short time and small number of workers it is probable that the survey was not quite complete. The places are indicated by a red spot on the map at the beginning of the report.

Most of the places are tanks. These are not the large well-made tanks containing comparatively clean water, for in such I have never found anopheles larva, but small tanks generally containing rather foul water and often a fair amount of low vegetation, more or less corresponding with the duck ponds to be seen on village greens in England. Many of the anopheles tanks contained quantities of fish and tadpoles, but in the majority of these the anopheles larva was not plentiful, except perhaps in a corner shut off by floating bamboos thrown into the water to soak. So it appears probable that they do feed on them and keep down the numbers if they have no other food that they prefer, though they do not as a rule entirely prevent their breeding. It is more usual to find anopheles on the leeward than the windward side of a tank. They are not generally found in the filthiest tanks containing practically sewage and teeming with low forms of animal life.

Anopheles were not usually found in drains, containing sewage, which formed breeding grounds for some of the varieties of culex, but in some instances they were found in stagnant ditches which contained the waste water from stand-pipes. One place that was found to swarm with them was a masonry tank about 12 feet square and 2½ feet deep which was newly made to soak bricks in. Excavations in the ground containing water contained large quantities of larva, more so than and other places, evidently forming the most favourable breeding grounds, but as the search was made in dry weather most of these were dried up. Excavations in tanks which had been de-watered for the purpose of deepening them were found to contain the larva plentifully. It will be seen from the map that the town proper contained only a very few breeding places for anopheles on the extreme north. This is attributed to most of the filthy tanks having been filled up or improved. There is a fringe of red spots to the east of the Circular Road, which has always been considered one of the most feverish parts of the town. There is also a group in Bhowanipur and another in Kasapara on the south of the town. Hastings, Ward 18, is shown to have a very high fever mortality, but contains only one large tank containing clean water, in which I found no anopheles or other mosquito larva. I investigated this and found that the blocks to which the heavy rates from fever and all cases were ascribed were not inhabited by regular residents of Calcutta but by military men and followers of the Transport Service and that the population had been vastly under-estimated. Block I of the census report, which is occupied by barracks, has a death-rate from fevers 124·0 and from all causes of 262·7 per 1,000 per annum, which must have attracted notice if it had occurred. A block close by, which is mostly bustee, has a death-rate from fevers of 10·35 and a total death-rate of 20 per 1,000 per annum. When a population mainly consisting of selected young adults who have passed a medical examination for admission to the army is shown to have an almost unprecedented mortality and a poor bustee population of all ages living in huts in the immediate neighbourhood to have only a fraction of that mortality, it is tolerably evident that there is something wrong with the figures. The following statistics of the population fever mortality and general mortality of Hastings, block by block, show this clearly :—

Census blocks.	General character.	Census population of 1891.	Average deaths from fevers for five years.	Ratios of fever mortality.	Average total deaths for five years.	Ratios of mortality for five years.
Block 1 ...	Barracks and Offices ...	137	17	124·0	36	262·7
„ 2 ...	Good Residential Quarter ...	605	9	140·8	25	41·3
„ 3 ...	Poor bustee people connected with the river.	2,126	22	1·3	46	21·6
„ 4 ...	Mainly bustee	598	3	5·0	12	20·0
„ 5 ...	Transport lines	979	12	12·2	31	31·6
„ 6 ...	Mostly bustee	375	10	26·6	28	74·6

So far I have found no anopheles larva in the water on paddy-fields though I have walked over many miles of them. Captain S. P. James, I.M.S., however, found the rice fields round Quilon to be the principal breeding ground. I have found none in wells though I have not examined very many : I have found other varieties of mosquito breeding in them. Mahomed Bux informed me that Major Ross found them in two wells in Bhowanipur, but when I went to examine them I found that they had been filled up. In many places where anopheles larva was found it could not be seen with the naked eye, but when a tin dipper and a porcelain dish were used they could be seen. This was either because they were very small not being full grown, or because there were not many of them ; sometimes only one or two would be obtained in several dips.

Some experiments were tried in the extermination of anopheles larva. It was found that they could be quickly killed in pools with kerosine oil, but re-appeared again in about a week. So if they were confined to small pools and the breeding places were not too numerous their extermination would not be a very difficult matter. Most of them could be killed off by kerosining the pools every few days and the pools filled up or drained. The tanks, however, present much greater difficulties, as it is difficult to cover the surface of even a small tank that contains much vegetation with kerosine. Our experiments in this direction were by no means a success. I did not try crysanthemum or any of the

other mosquito larvicides. Though the difficulties are very great I do not think they are insuperable. Much good would probably be affected by filling up or improving the foul tanks in which anopheles breed. It is doubtful whether tanks of the better class contain enough pabulum for their sustenance: it must be remembered that the male mosquito is not a blood-sucker and has to obtain sufficient sustenance in the larval state to last him his life-time. Another important point is that mosquitoes do not generally travel far from their breeding-places but sit tight under shelter when the wind is strong, so, though anopheles mosquitoes are very prevalent on the other side of the canal on the east, if they were once exterminated in the town it is doubtful whether they would come in from outside to any extent. All things considered it does not appear probable that any appreciable effect can be made on the prevalence of malarial fevers in Calcutta with an expenditure of Rs. 30 (about £1) a month including the pay of establishment, though that has been found to be sufficient for a preliminary investigation into the prevalence of anopheles.

Cholera.—The mortality from cholera, though above that of the preceding year, was much below the average of the previous five years. The number of deaths was 990 against 665 in 1898 and against 2,051, the average of the previous five years, giving a death-rate of 1·45 against 0·97 and 3·00, respectively. The figures for the Towns and Suburbs are as follows :—

——	1894.	1895.	1896.	1897.	1898.	Average of five years.	1899.
Town	1,118	1,302	2,377	1,543	457	1,359	648
Suburbs	577	797	1,072	806	208	692	342
Total	1,695	2,099	3,449	2,349	665	2,051	990

The mortality according to season varied as follows :—

January.	February.	March.	April.	May.	June.
165	85	83	67	125	30
July.	**August.**	**September.**	**October.**	**November.**	**December.**
141	39	10	42	68	145

The unusually large number of deaths during May is attributable to a larger number of deaths among Mahomedans about the time of the *Mohurrum* festival; and the excessive mortality during July was due to the influx of large numbers of pilgrims returning from Puri, where cholera was present in an epidemic form at the time.

The mortality varied likewise according to locality, the largest number of cases being recorded in wards Bhowanipur, Jorabagan, Shampooker, Colootola, Coomartooli, and Jorasanko, with 118, 83, 80, 65, 64, and 61 deaths, respectively.

Of the total of 990 fatal cases, 107, or 10·8 per cent. were imported from places beyond the limits of Calcutta, 101, or 10·2 per cent., were pilgrims on their way home from Puri, and 51, or 5·1 per cent., had visited Kalighat to offer sacrifices immediately before attack; and 201 cases had made use of the Hooghly river water, and 35 of the water of local tanks for domestic purposes shortly before they were attacked by cholera. The cases were mainly isolated ones, occurring singly in the majority of instances. In a few places two or more cases occurred in the same localities, which might be considered small outbreaks.

In connection with cholera cases which occurred in the town, 244 samples of water from the Hooghly river, Circular Canal, Tolly's Nullah, and local tanks, wells, bathing-platforms and filtered water supply, as well as of milk and other articles of food were tested bacteriologically for the detection of *comma bacilli*, and in five samples of tank water *commas* were

detected. It is, moreover, worthy of note that a sample of water from a tank at Puri received from the Sanitary Commissioner for Bengal was similarly examined, and was found to contain *commas*.

Small-pox.—The mortality from small-pox was below that of each of the previous five years. The number of deaths registered was 64, against 85 in 1898, and against 588, the average of the preceding five years, giving a death-rate of 0·09 against 0·12 and 0·86, respectively, per thousand of the population per annum.

The outbreak commenced with one fatal case in November and seven cases with two deaths in December, 1898, continued during the first half of 1899, reaching its maximum in March, then after an interval of two months during which no fatal case occurred, recommenced in September and got worse towards the close of the last quarter.

The mortality varied much according to locality. The whole of Shampuker, the Added Areas of Burtolla and Sukea's Street, as well as all Bowbazar, Bamunbusti, Hastings, Baniapooker, Ballygunge and Alipur were entirely free from the disease throughout the year; and though two cases occurred in the Town Area of Sukea's Street, one in Park Street and one in Bhowanipur, they all recovered and did not lead to other cases.

The wards which had the largest number of deaths from small-pox were Watgunge, Colootola, Moochipara, Entally and Puddopooker, with 25, nine, six, six, and four deaths, respectively. The cases in Watgunge all took place during the first six months of the year, while those in Colootola, Moochipara and Puddopooker occurred during the last four months of the year. The cases that took place in Entally, on the other hand, occurred at two different periods with an interval of several months between, namely, four in March and April, and two in November and December.

It is worthy of note that a total of 138 cases of small-pox came to notice during the year, of which 64, or 46·3 per cent., ended fatally, and that the wards which had the greatest number of cases were the same as had most deaths, namely, Watgunge with 44 cases, Colootola with 27 cases, Moochipara with 16 cases, Entally with 15 cases, and Puddopooka with 6 cases. To this list, however, Jorasanko has to be added, with seven cases of which only one died.

Vaccination.—The total number of persons vaccinated during the year was 16,011, against 13,255 in the previous year. Of these 13,394 were primary and 2,617 were re-vaccinations, against 11,569 and 1,686, respectively, in 1898, thus showing an increase of 1,825 primary operations, and 931 re-vaccinations. The increase was mainly due to the presence of small-pox in the city during the greater part of the year.

Of the 13,394 primary vaccinations 12,674, or 94·62 per cent., were successful, 440, or 3·28 per cent., were unsuccessful, and in 280, or 2·09 per cent., the result could not be ascertained. The rate of success calculated on the ascertained cases was 96·64 against 99·07 in the previous year. Of the 2,617 re-vaccinations 532, or 20·32 per cent., were successful, and in 1,117, or 42·68 per cent., the result could not be ascertained. If the unknown cases are excluded from the total, the rate of success in the re-vaccinations was 35·46 per cent., against 23·68 in the previous year. The lower percentage of success in primary vaccination as compared with the previous year is attributed to the unsatisfactory character of some of the vaccine received during the year.

Of the total of 16,011 persons vaccinated, 8,855 were males, and 7,156 were females. According to nationality 10,930 were Hindus, 4,456 Mahomedans, 445 Christians and 180 of other classes. Of the 13,994 primary vaccinations, 8,828 were Hindus, 4,128 Mahomedans, 284 Christians and 154 of other classes. 2,548 were under one year, 10,442 were one year and under six years, and 404 were six years and upwards.

Vaccination was performed during the greater part of the year with vaccine obtained direct from vaccinated calves received from the Animal Vaccination Depôt in Calcutta, or with lanoline paste obtained from the same source. In the latter part of the year, however, in consequence of an outbreak of rinderpest among the calves the vaccine supply from that depôt failed from the 20th November to the 3rd December; and from the 4th to the 17th December the supply was insufficient. In consequence of this some lanoline paste was obtained through the Sanitary Commissioner from the Animal Vaccination Depôt at Darjeeling; but as the majority of the vaccinations performed with this paste proved unsuccessful, a quantity of glycerised vaccine was procured from Madras. The following table shows the comparative rates of success in primary vaccinations obtained

from the use of calf lymph, lanoline paste, glycerised vaccine and humanised lymph, respectively :—

Particulars.	Calf lymph.	Lanoline paste (from Calcutta Depot).	Lanoline paste (from Darjeeling Depot).	Glycerised vaccine (from Madras).	Humanised lymph.
Total No. vaccinated	4,701	8,152	400	68	73
No. inspected	4,589	8,002	383	67	73
No. successful	4,576	7,925	67	63	43
Rate of success per cent. on ascertained cases	99·71	99·03	17·49	94·03*	58·90

* Some of the tubes were rather old when they were used, which accounts for the comparatively low rate of success.

As stated in the last annual report, a complete scheme for the re-organization and improvement of the Vaccination Department of the town was submitted to the Corporation in the early part of the year under review. It was considered by the General Committee on the 9th June, and adopted with certain modifications.

The following figures show the case mortality among the unprotected compared with that among the vaccinated :—

—	Total No. of cases.	No. of Deaths.	Case mortality rates per cent.
Vaccinated...	42	14	33·33
Unprotected	68	37	54·41
Inoculated	20	10	50·00
Having had natural small-pox	3	—	—
Previous protection unknown	5	3	60·00

Laboratory work.—During the year 1899, 47 samples of river water as pumped into the settling tanks at Pultah, and 47 samples of the same water after settling were partially analysed. Twelve samples of impure river water and 47 samples of filtered water from the town supply were subjected to a fuller analysis. The river water contained on the average less suspended solids in 1899 than in the previous year, the total solids in the water after settling were likewise less than in 1898, and the filters separated less solids. It may be noted that on several occasions mere settling was sufficient to remove all suspended solid impurities, chemical analysis showing no appreciable difference in the water before and after filtration. The filtered water showed a further increase in its total hardness over the preceding year, though the permanent hardness was practically the same as in other years. As the filtered water possessed this character in common with the impure river water, the steady increase in the total hardness which has been observed during the past three years is probably due to some new source from which increasing proportions of earthy salts are coming down the river since 1897, the year of the recent earthquake, The proportion of dissolved chlorides in the filtered water during the first half year was higher than that of the previous year, though much below the figures of 1896 and 1897; and it was observed to be inversely proportional to the rainfall during the first quarter of the year.

Fifty-six samples of tank and well water were examined, and all but five were found to be unfit for domestic use.

The following food-stuffs were examined or analysed :—169 samples of ghee, 135 of milk, 21 of arrowroot, 16 of barley meal, 16 of butter, four of flour and two of tea, and

59 samples of ghee, 81 of milk, 17 of arrowroot, 10 of barley meal and one of butter were found to be adulterated, and four of ghee, and 22 of milk, inferior in quality. Samples of disinfectants and of miscellaneous articles were also tested.

Two hundred and forty-four samples of water, milk, and other articles were tested for *comma bacilli*, but *commas* were defected only in five samples of tank water. A number of samples of blood from suspected cases of enteric fever, sputum from cases of tuberculosis and various specimens and cultures from suspected plague cases were tested by bacteriological methods for the purpose of diagnosis. A case of scarlatina occurring at the Female Orphan Asylum was also investigated.

The illuminating gas-supply of the city was examined photometrically and chemically. Its illuminating power averaged 16 standard candles, and the average pressure of supply was $\frac{8}{10}$ths of an inch. The gas was free from sulphuretted hydrogen, and every 100 cubic feet contained on the average 1·8 grains of ammonia and 2·0 grains of sulphur in the form of compounds other than sulphuretted hydrogen.

ABSTRACT OF THE REPORT OF THE MADRAS MUNICIPALITY FOR 1899-1900.

(*Lieutenant-Colonel G. M. J. Moore, President.*)

Births and Deaths.—The total number of live-births registered during the year 1899 was 18,220, against 18,694 in 1898. The ratio per 1,000 per annum calculated on the census population of 1891 was 40·2, against 41·3 in the previous year. The decrease is without doubt due to the hard times, the price of the staple grains remaining high throughout the year. The number of still-births registered during the year was 253, a proportion of 1·3 still-births to every 100 born alive. The male births numbered 9,336 and the female 8,884, giving a proportion of 105·0 males to 100 females.

According to caste the birth-rate among the Mahomedans was 43·2 per 1,000 ; among the Hindus, 40·1 ; among the Christians, 37·6 ; and among the others 3·3.

Mortality.—During the year 1899 there were 17,248 deaths registered in Madras, giving a death-rate of 38·1 per 1,000, calculated on the census population of 1891, against 20,286, or a ratio of 44·8, in the previous year, the average for the decade being 18,461·6. In 1898 the number of deaths was greater than the births by 1,592 but in 1899 the number of births was greater than the deaths by 972. Of the 17,248 deaths registered, 8,631 occurred among males and 8,617 among females, giving a proportion of 100·1 to 100.

The number of deaths according to nationality was Europeans, 75 ; Eurasians, 375 ; Native Christians, 760, Hindus, 13,878 ; Mahomedans, 2,156 ; and others four. The ratios per 1,000 are 30·4 among Christians, 38·6 among Hindus, 40·5 among Mahomedans and 6·7 among " others " against 36·8, 45·8, 44·5 and 10·0 of the previous year.

During the year under report the number of deaths from fevers was 3,317 against 5,489. This decrease is no longer explicable on the grounds that people avoided reference to fever for fear of inquiries about plague. Either deaths attributed to fever have really for some unknown reason decreased or some other fancy influences the public when naming the cause of death. The deaths from " measles " have fallen very low, *i.e.*, from 775 to 291, while the deaths from " diarrhœa and dysentery " have risen high from 3,302 to 3,520 respectively. But the deaths from small-pox have decreased from 116 to 34 and cholera from 778 to 23. Four deaths occurred from plague.

Statement of Mortality from the prevalent diseases in 1899 *contrasted with that of* 1898.

Years.	Plague.	Small-pox.	Measles.	Fevers.	Dysentery and Diarrhœa.	Cholera.	Total.	Other Causes.	General Total.	Ratio per 1,000.
1898	7	116	775	5,489	3,302	778	10,467	9,819	20,286	44·8
1899	4	34	291	3,317	3,520	23	7,189	10,059	17,248	38·1
Average for 10 previous years.	0·9	52·3	535·9	5,849·2	2,918·7	472·3	9,829·3	8,632·3	18,461·6	40·7

Mosquitos and Malaria.—In connection with the mosquito-malaria problem search was made for the breeding places of anopheles with the view of ascertaining the practicability or otherwise of exterminating the genus from the City limits.

Instead of the very limited distribution that one had been led to expect, the larvae were found to be very widely distributed and were collected in the following spots :—

1st Division ...	No search made.	6th Division ...	Swamp in Brick Kiln Road.
2nd „ ...	An old well.		Paddy Fields.
3rd „ ...	An old well.		Pools of rain water in open land.
4th „ ...	Swamps.	7th „ ...	Old wells.
5th „ ...	An old well.		The Cooum.
6th „ ...	Old wells.	8th „ ...	Old wells. Paddy fields. Swamps.

No very exhaustive search was made, but it may fairly be assumed that it they were found in one well in a division the probabilities are greatly in favour of their being found in other wells also, and the fact that they were found in almost all the likely places that were searched renders it pretty certain that it is only necessary to look to find them in each quarter of Madras. The only indispensable conditions with regard to the presence of anopheles larvae in wells seem to be—

1. That the water should be undisturbed.
2. That it should contain plenty of vegetable matter and floating garbage for them to feed on.
3. The water should not be very salt.

If wells, therefore, are regularly used and kept free from refuse and vegetation, neither anopheles nor any other kind of mosquito can flourish in them.

There is no fact here to militate against Ross's theory or the later dictum of Grassi that without anopheles there can be no malaria. It has long been known that every part of Madras furnishes cases of malaria ; it is now known also that every division of Madras contains spots suitable for the propagation of anopheles, and that anopheles actually exists in the majority of them. The larvae cannot be found with equal facility at all seasons of the year, they seem to be most plentiful during the colder months, that is, after the monsoon. The connection between the quantity of water lying about in swamps, the condition of the paddy fields and the prevalence of mosquitos is obvious. No systematic attempt was made to find the anopheles imago in different parts of the town, but it was casually discovered in the Madras club, in the resident surgeon's quarters, general hospital, and in a bungalow in Nungambakam.

The questions now arise. How can the anopheles mosquito be exterminated on the one hand, and how can the man with malarial parasites in his blood be controlled so that he may not be a danger to the community on the other? The researches of Ross, Grassi, and many others, have established that the most frequent if not the only cause of malaria in the human subject is the bite of the anopheles mosquito, that the mosquito must be previously infested with the malarial parasite obtained from the blood of a malarious patient, that one bite by an infested mosquito is sufficient to convey the disease to a healthy person, that in regions where there are no anopheles there can be no malaria, and that where anopheles exists its bites are innocuous unless it has been able first to bite a person in whose blood the malarial parasite is already flourishing.

Whether the malarial parasite has any existence outside the bodies of men and mosquitos, and how it originally obtained entrance into the one or the other, is still as great a mystery as the origin and spread of all the other microbic and parasitic diseases.

It would appear, then, to all but a few prejudiced individuals, that the mosquito-malarial theory is sufficiently developed to be acted on, and it has become the duty of all Governments and corporate bodies, no less than of individuals, to make every effort to check the spread of this scourge on economic if not on humanitarian grounds.

The answer to the first question presents at first sight difficulties almost insuperable. The larvae to be exterminated are found in old wells in all parts of Madras, in a few swamps, in the Cooum, and, last but not least, in paddy fields. If all the old wells are filled up or kept clean, if the swamps were drained, if a flow of water could be secured in the Cooum, or at any rate it could be kept clean enough to allow the bottom to be seen anywhere, and if wet cultivation were stopped within municipal limits, then anopheles could not exist; and with its disappearance, barring importations, malaria would also die out. To make all these improvements involves the expenditure of large sums of money and the lapse of several years. Endeavours will be made to fill up many useless wells and get owners and occupiers to periodically clean the rest. During the past year a good many have actually been filled, some of which had been found to harbour anopheles.

The swamps known to breed anopheles are four in number :—

(1) North of the Mylapore sewage farm, formed partly by the escape of filtered sewage and partly by the bed of a useless arm of the Buckingham canal at Barber's bridge. This is being filled up with rubbish and in the course of time will cease to exist.

(2) Brick kiln road. A large low lying tract, part of which is always swampy, and the rest swampy for several months after heavy rain. This is slowly being filled with rubbish.

(3) North of Capper House Hotel.

(4) Surrounding the Harness Factory.

The Cooum all round the island, opposite the General Hospital, and opposite Napier Park, was found to provide ample sustenance for millions of anopheles in the months of January and February.

Paddy fields in Egmore, Nungambakam, Kilpauk and Teynampet, were found to be swarming with anopheles. Whether it is practicable or not to stop all wet cultivation within Municipal limits remains to be seen; at any rate there seems to be no particular reason why some of the tanks which irrigate only a few paddy fields should not be breached and used for other purposes. Spur tank, Egmore, is one of these, and there is a double reason for recommending its abolition. In addition to the fact that only half a dozen tiny paddy fields derive any benefit from it, it is one of the places in which dhobies delight to wash the clothes of persons of otherwise cleanly habits; and there can be no question that the quality of the water it contains renders it quite unfit for the purpose. There would be little hardship entailed on anyone by its closure, and the compensation to the paddy fields owners would be but small. Madavakam Tank is another which does not irrigate a large area. When Viyasarpady, Nungambakam, and Mylapore tanks, come to be considered in this light, the question assumes more serious proportions, for the number of paddy fields and gardens which are supplied by the latter especially is very large.

By dealing with all the localities within municipal limits in which anopheles does and can breed, a considerable reduction in their numbers would presumably be effected and though they might still flourish in the paddy fields of Saidapet Taluq they would not be likely to invade the city in large swarms.

Besides filling and cleaning wells, draining and filling swamps, and abolishing wet cultivation within the city limits, other alternative systems of prevention have been suggested, notably that of covering the surfaces of breeding places with films of mineral oil. This of course is not applicable to paddy fields, and practically it is no easy matter to get kerosine oil to spread over the surface of water unless considerably larger quantities than are absolutely necessary are used, and the water is freely agitated. The film, moreover must be constantly renewed as the oil evaporates. If all the available breeding places were regularly oiled no doubt the mosquitos could be prevented from breeding, and, with the exception of visitors from Saidapet, would soon cease to exist: but the expense incurred in purchasing oil and maintaining an efficient staff to properly distribute it would be large, and to be of any use would of necessity be perennial.

The employment of potassium permanganate and other chemicals need not be touched upon, since, as far as is known, they are either ineffectual or their use is attended with grave objections.

The second method of attacking the malaria question, by dealing with those members of the population who are already infested with the parasite, though viewed with favour in Italy, seems in Madras at any rate likely to be unsuccessful. The thousands of natives who at present must be harbouring the parasite could by no means be isolated: and even supposing they were kept apart till they either died or were cured, there would be a continual influx from other parts of the country of infested individuals, who would afford the anopheles fresh opportunities of asserting themselves. Not unless the whole malarious population could be dealt with simultaneously would this method be of any avail. It remains, therefore, to destroy anopheles ruthlessly, wherever discovered, by depriving them of places where they can breed: and though this is within the bounds of possibility within a limited area such as Madras or any other city, it is not easy to see how it can be accomplished over thousands of square miles of a country under wet cultivation. Still, if the number of persons who die from malaria were limited to those who have contracted the disease in the mofussil, a considerable change might be expected in the city fever returns.

Certain accepted dicta concerning the distribution of malaria which are not in accordance with the new theory, required to be substantiated or proved false. It seems to be most unpalatable to many lay minds (medical objections may be neglected, for there are opponents to be found to every theory and rule of practice, be it new or old, and some show of reason usually accompanies such opposition) and is condemned in a breath with vehement and unsupported assertions. It will have to be shortly determined by competent observers whether malaria is endemic in any part of India in which anopheles does not exist, and, conversely, whether anopheles is found in any place in which there is no malaria, and, in the latter case, whether the introduction of a man suffering from malaria can start an epidemic. If anopheles is universally distributed in the paddy fields throughout the Presidency it would appear impossible for any native cultivator to escape periodical attacks. Either anopheles does not so prevail, or the cultivators have become

almost immune, or the type of disease is mild, and does not cause much interference with their daily work, or lead to total disability in the course of years, or there is some other unknown factor inhibiting the extra corporeal propagation of the parasite and rendering the bite of anopheles innocuous. In some old report on the relation between fever and irrigation it is stated that in Tanjore and Trichinopoly, which are freely irrigated by the Kaveri, there is but little fever, while in Bellary, Kurnool and Cuddapah there is little irrigation but much fever. It is not yet known what the relative numbers of anopheles in these districts are. If it be true that malaria has become more prevalent in Madras City during recent years, *i.e.*, since the introduction of pipe water, a statement which, in the face of the known unreliability of all the available statistics, can never be proved, support is derived from the fact that many wells, which formerly were in daily use and were kept clean, are now merely receptacles for garbage and breeding places for mosquitos.

As regards the species of anopheles discovered in Madras there were three only ; one very common and the other two very rare and never found separately from the first. As the common one was many times bred from the larvae, and even from the ova, through the nymphal stage to the perfect insect and carefully compared in each metamorphosis, there can be no doubt upon this point. Whether the specific name of this insect is Claviger or Pictus is not known. Its most obvious characteristic is the four bars visible to the naked eye, formed by the pigmented scales on the costal margin of the wings. The pigmented scales are confined to the costal margin, the costal and subcostal nervures. The other scales showed only a light yellow colouration. In the second species instead of four bars there are two only, the proximal one being about three times as long as the distal. In the third species there are three deeply pigmented bars along the costal margin. All the other scales are also pigmented, but less deeply, with the exception of four rows of unpigmented scales along the costal margin separated from each other by the three pigmented bars.

It remains to collect and classify all the different species of anopheles, if not of culex, in Madras and to determine which of them are capable of transmitting the disease, a work of no little magnitude. Anopheles may or may not live side by side with culex in wells ; in swamps the genera usually occupied different localities and lived apart ; in paddy fields they live apart ; in the Cooum sometimes together and sometimes apart. Though large and voracious culex larvae were often seen to devour newly hatched and delicate anopheles larvae in captivity, it is quite certain that to encourage culex on a large scale in order that it may eat up all the young anopheles, as has been suggested, would not be a desirable experiment. Culex probably only takes to cannibalism when its usual diet fails.

Small-pox.—The total number of deaths registered in 1899 from small-pox was 34 against 116 of the previous year. The small-pox of 1899 was a continuation of that which commenced in the beginning of 1898. The incidence on the vaccinated and unvaccinated is shown in the following table :—

——	Attacks.	Deaths.	Fatality.
Unvaccinated	47	18	38·3
Said to be vaccinated but no marks	27	11	40·7
Vaccinated	28	4	14·3
Had previous attack of small-pox	1	1	100·0
Total	103	34	33·0

——	Total deaths.	Under 10 years.	10-20.	Over 20.
Unvaccinated	18	16	1	1
Vaccinated	4	1	1	2

Cholera.—There was but little cholera during the year. A localised outbreak occurred in the Nungambakam village, the origin of which failed to be traced. The first attack was on May 19th and the last on June 4th. Fifteen cases in all, distributed over nine houses, came to light during that period and nine of them died. All the persons attacked were Sudras, with the exception of one Brahmin and one Pariah. The Sudras were in the habit of drinking water drawn from one well which was first Hankinised on

21st May. The Brahmin used water from another well reserved for that caste, and the Pariah probably obtained water from one of the Sudras. As far as could be ascertained only these two wells were used by the affected persons. Eighteen other wells in the neighbourhood were, for precaution's sake, Hankinised, and the people who used them sent to the taps for their supply. It appeared to be extremely probable that this Sudra well was the means of spreading the infection, but in the absence of any facilities for making a bacteriological examination nothing can finally be known. The condition of the well at any rate, afforded ample opportunities for contamination, as its parapet was broken away and it was situated in the middle of paddy fields, which were both artifically and naturally manured by human excreta, and through which all persons had to pass in order to reach the well. Nothing could then have been easier than for infective material to have been washed off the feet of the water drawers into the well, which as before mentioned had no parapet or platform around it.

After the epidemic had subsided, since this well was temple property, and in some degree sacred, it was not closed, but the owners were compelled to put it into proper repair. The villagers were warned of the danger they ran in drinking water from such wells and two more fountains were erected to supply Red Hills water for their use.

Besides this small outbreak, there were five other deaths from cholera during the year, making 23 in all.

Plague.—During the year four deaths occurred from plague, against seven in the previous year. All of them were imported cases.

Measles.—The number of deaths registered from measles was 291, against 775 in the previous year.

Bowel Complaints.—Under the heads of dysentery and diarrhœa there were 3,000, and 520 deaths registered in 1899, against 2,750 and 552 of 1898.

Infantile Mortality.—There was a visible fall in the rate of infantile mortality during the year under report from 404·2 deaths to every 1,000 births of 1898, to 363·8 deaths to every 1,000 births of 1899. The total number of deaths for the year registered under this head was 4,973, against 5,525 of the previous year.

Vaccination.—The total number of cases vaccinated during the official year 1899–00 was 24,959, against 28,186 in 1898–99, showing a decrease of 3,227 cases. The decrease is due to the less prevalence of small-pox during the year when compared with 1898–99.

Out of 24,959 cases vaccinated, 14,457 were males and 10,502 females. Out of 24,959 vaccinations performed, 22,428 were successful, 1,220 unsuccessful, and 1,311 unknown. The large number of unknown cases was due to the release of the convicts of the Penitentiary undergoing short terms of imprisonment of from three to five days, before the result of the operation could be ascertained. Also to the Natal emigrant coolies who after vaccination were rejected as being physically unfit before they were brought to the Vaccine Depôts for inspection of result.

Out of a total of 24,959 cases vaccinated, 10,013 were brought to the Vaccine Depôts for inspection under Bye-law 5 of the revised bye-laws, dated 22nd February, 1898. The result of 12,749 cases vaccinated excepting the Jail convicts (2,197) were ascertained by the respective Divisional Vaccinators, and the parents who failed to comply with the bye-laws were reminded and warned to take their vaccinated children to the depôts for inspection of the Vaccinator. This procedure was adopted to reduce the number of prosecutions under Bye-law 5. The results of 2,197 cases vaccinated in Her Majesty's Penitentiary were verified by the Deputy Inspector of Vaccination during his weekly visits.

The percentage of success both in Primary and Re-vaccination, excluding the unknown cases from the total was 94·84, showing a decrease of ·95 per cent. below the year 1898–99. The decrease is accounted for to the low percentage of success obtained in re-vaccination, which fell from 83·18 in 1898–99, to 76·36 in 1899–00.

The subjoined table shows the result obtained in both primary and re-vaccination as compared with 1898-99 :—

Year.	Primary Vaccination.				Re-vaccination.			
	Successful.	Percentage.	Unsuccessful.	Unknown.	Successful.	Percentage.	Unsuccessful.	Unknown.
1898-99	20,147	99·48	105	375	4,919	83·18	994	1,646
1899-00	18,722	99·61	73	287	3,706	76·36	1,147	1,024

Of the total vaccinated 1,453 were Europeans, East Indians, and Native Christians, 2,418 Mahomedans, 21,083 Hindus, and five other castes. Out of 24,959 cases vaccinated 19,082 were primary vaccination, against 20,627 in 1898–99, showing a decrease of 1,545 cases. The percentage of success in primary vaccination was 99·61, showing a small increase of 13 per cent. over the previous year. The number of re-vaccinations performed among adults was 5,877, against 7,559 in 1898–99, showing a decrease of 1,682 cases. The percentage of success was 76·36, showing a decrease of 6·82 per cent. below the year 1898–99.

During the year 13,530 infants under one year of age were vaccinated, against 15,643 in the previous year, showing a decrease of 113 cases. The percentage of success obtained in the infantile vaccination was 99·73, against 99·58 in 1898–99, showing a small increase of 15 per cent.

Meteorological Conditions.—The Government Astronomer reports as follows :—"Temperature—was below the average for April, October, and December, normal in January, and above the average for other months. The highest shade temperature recorded was 104°3 F. on the 29th May, and the lowest was 60°1 F. on the 25th January. Rainfall was above the average in April, July, September, and October, and below the average in all other months. The deficiency for the year was 8·02 inches. During October 22·29 inches fell, and the heaviest fall in one day was 2·96 inches on the 23rd of that month. The total fall in November and December was only 1·79 inches."

Plague Measures.—Plague measures this year resolved themselves mainly into the development and supervision of the passport system. No further extensions of existing hospitals or camps were made, and only a few necessary repairs were executed.

Three of the four Plague Officers were recalled to military duty, and the remaining one, Captain Loudon, took charge of the passport offices and prosecutions. The remainder of the sepoys also returned to their regiment in June, 1899.

The English Plague Medical Officers were also one by one removed, the last leaving in December. Reductions were made from time to time in the staffs of the hospitals and camps. Egmore hospital alone has now a sufficient staff to fulfil immediate requirements.

The forecast is still not a bright one, although the feeling appears to be stronger than ever among many people that Madras, by reason of its position on the map, is immune against plague. No doubt it is a comfortable view to take, but likely to lead to difficulties if literally acted upon. No one can definitely assert that plague cannot live here; the most that can be with safety put forward as a working hypothesis is, that the climate is unfavourable to the propagation of the bacilla. Those to whom this hypothesis commends itself tacitly commit themselves to the assumption that cases have actually occurred in the town unknown to the authorities, and that the disease has spontaneously died out without spreading beyond those who brought it from some infected area. It is an established fact that plague does not readily fasten upon a new town; while one importation may be sufficient to start an epidemic, few would deny the possibility of the importation of several cases which might either die or recover in their houses without harming any one else, even so the risk would be great. There is no evidence that such a thing has occurred here, nevertheless the passport system is not infallible, and any day some infected individual might evade its regulations and start a focus of infection in the town.

It is preferable that good fortune has so far saved the town by permitting the discovery of every importation.

Sanitary Defects and Sanitary Progress.—The Mylapore drainage system has continued to work sufficiently well to justify an extension on the same lines into other divisions with a few minor modifications. The fall that could be obtained was not enough to enable the pipes to be self-cleaning, even with the aid of numerous flushing cisterns, and a permanent staff has been employed to drag straw balls systematically from beginning to end of the different branches to keep them clear of silt.

The house connections give some trouble, chiefly on account of the depth and narrowness of the traps, a new pattern of which should be employed in the future. An inconceivable quantity of sand and mud finds its way from the house court yard into these traps, where it is mostly arrested, and unless they are regularly flushed they get blocked up. Cocoa nuts, casual snakes, and other foreign bodies, not unfrequently give rise to more serious obstructions, and a permanent staff has to be maintained to flush these house connections regularly from the outside to clear out the obstructions, and where this cannot be effected, to break the pipe and insert a new one, but the latter course is but rarely necessitated.

In heavy rain, owing to the narrow lumen of the trap and the small size of the overflow hole, the water finds some difficulty in escaping rapidly from the house courtyards, and if a trap gets blocked at the same time, the courtyard remains under water unless the occupier waxes impatient and demolishes the offending house connection with a crowbar.

Another unpleasant experience, suffered by a few of the occupants of certain houses on low ground near the ending of a sewer, was the backing up of sewage through the house connection into the courtyard, which happened when the upper lengths of the sewer on a higher level than the house courtyards were running full as well as the main sewer with which these houses were connected.

The year was spent in discussing the relative qualities of different kinds of pipes for use in the drainage of the rest of the town. Choice eventually fell on the thicker kind of cast iron pipes for the high level main, and on English stone-ware pipes for the sewers and branches. The materials of which the sewer pipes under consideration consisted were glazed earthenware. The difficulty in deciding whether the cheaper cement was strong and durable enough was overcome by a timely discovery in Mylapore. The sewer coolies one day found that one of the recently laid 18″ pipes was obstructed, and on opening up the ground a larger number of cement pipes were seen to be longitudinally cracked. A few intercalated stone-ware pipes were, however, intact. In one place the roots of a tree had insinuated themselves into the cracks and entirely broken up the pipes. The cause of the cracks could not be with certainty determined, but their presence was considered to justify the condemnation of cement pipes.

A point of great importance must not be lost sight of in this connection. Night-soil is now disposed of in four depôts. The carts of Divisions 1, 2, and 3 go to Manally depôt in the North. Here the night-soil is emptied on the surface of the ground, and is at times sold by the rubbish contractor to cultivators. Being far away from human habitations this place does no particular harm, though the smell it gives off at close quarters is probably unequalled.

The carts of Divisions 4, 5, and parts of 6 and 7, go to Brick-kiln road, and their contents are buried in trenches. The ground available is much too small, and is chiefly clay, and therefore the worst that could have been selected. Moreover, it is under water during heavy rains and cannot be used for a few weeks, which leads to great difficulties. The carts of Divison 6, and parts of 5 and 8, go to Stirling's Road trenching ground. This is sufficiently large, and if properly looked after, need cause no offence.

The rest of the carts of 7th and 8th divisions go to Mylapur trenching ground. Here again there is not enough room to carry out the operation satisfactorily and without offence.

As time goes on the difficulties of to-day will tend to increase; there will be better conservancy, more carts, and possibly more people, and therefore more night-soil to dispose of. Trenching, though an extremely satisfactory system in a place where there is only a small population, and when suitable areas of land are available, cannot be recommended in large towns, and must shortly be discontinued partially, if not entirely, in Madras. When the iron high level main is completed, it will be possible to abandon trenching to a great extent, and to establish stations at convenient points along the main where the night-soil carts can come and discharge their contents into chambers connected with the main. By the employment of some agency, such as compressed air, the contents of these chambers could be forced under pressure into the iron main, and the whole would be conveyed with the sewage to the North Black Town Sewage Farm. Since the carts would not have so far to go, they could make more trips in the day, and their number might accordingly be reduced. In the same way many of the public latrines could be so altered that the excreta could be directly flushed into the auxiliary sewers; and there is no reason why any householders, who so desire, should not have some form of water closet in their houses directly connected with the street sewer in place of the disgusting form of latrine which is now almost universally adopted.

The first consignment of iron pipes for the high level main has arrived, and the work of laying them will shortly be begun at the Black Town Sewage Farm.

The water-supply presents the same faults as before, many taps yielding a very muddy supply. Complaints are occasionally made of large numbers of fish being delivered, and everything points to the necessity of cleaning more of the pipes. This should be done little by little whenever a few rupees can be spared.

Nothing has as yet been done with regard to the dhobies. A Committee was appointed early in the year to consider the establishment of a dhoby khana, and select a suitable place, but the matter is still unsettled.

A few further improvements were carried out in private markets, and the new "Moore Market" is steadily rising. It is hoped that it will be opened before Christmas.

Many cattle yard owners were compelled to improve their premises, but they usually do the work in such an unsatisfactory way, and with such bad materials, that it only lasts a few months.

The Committee appointed to report on the question of Infectious Diseases Hospitals came to the conclusion that in the present state of the municipal finances nothing in the shape of a new hospital could be built and maintained, but that when the present stress due to plague has passed, then the buildings now used as plague hospitals might be of service.

Printed definitions and instructions are now issued with all building applications to explain to the builders the meaning of terms used in commenting on the plans they submit. It is ignorance as much as adherence to precedent that influences the construction of new houses.

While there is yet time some definite conclusions should be arrived at with regard to the height or number of storeys that should be permissable in contemplated buildings in different parts of the town. As land grows more valuable and trade concentrates, the tendency is to add to the height of buildings, instead of extending the area they cover. When streets are wide this may be indulged in without much harm, but with narrow streets, such as those of Madras, it will, if allowed to go much further, seriously interfere with proper ventilation. The matter has been given a good deal of attention lately in London and elsewhere; it is easily prevented before the houses are built, but afterwards may gave rise to immense trouble. As a rule, the height of houses should not exceed half the width of the street in populous quarters; height = width of street should be the maximum that could be under any circumstances permitted. This, of course, does not apply to buildings facing open land, or having extensive compounds. It will be found that this limit is already exceeded in many parts of Black Town.

One or two small burial grounds were closed with the sanction of Government, but the most offensive one of all, the sanction for the closure of which was obtained last year, unfortunately still remains in use, since all efforts to acquire another in its place have hitherto been unsuccessful. There is no reason why cremation should not go on at the DeMellow's Road ground, even after burials have been forbidden.

The flushing staff which had been organised in 1897, when strenuous efforts were being made to so improve the cleanliness of the town, that plague might not find a lodgment, had to be dispensed with for want of funds; the same deficiency leading to the departure of the 24 Conservancy Overseers. The latter, no doubt, relieved the Sanitary Overseers to a certain extent, but there was a feeling abroad that the good they did was not commensurate with the sum that was disbursed in wages. Three out of seven Sanitary Inspectors, and ten out of twenty Overseers, now possess bicycles bought from the municipality by monthly instalments. Increased mobility means increased efficiency.

Skin merchants were only given provisional licences for their godowns which are situated in populous localities, and were finally informed that they must shift them before the end of the year to the site allotted in Basin Bridge Road or elsewhere. No applications for plots have so far been received.

The Commissioners were asked by Government to consider the question of death certification. After some desultory discussions, in which the main points were entirely lost sight of, the matter was dismissed as being unnecessary or impracticable. That it is impracticable as far as a large proportion of the native population is concerned no one can doubt, as many die without medical attendance of any description and the certificates that would be furnished by the vadians who attend many more would be worthless for the purposes of statistics. But there are many Europeans practising in the town, and Eurasians and Natives with qualification obtained at the Madras University and elsewhere, not to mention pensioned Hospital Assistants, all of whom, it is maintained, should be registered and bound under penalty to certify the cause of every fatal case they attend, as well as to notify under penalty every case of infectious disease they may hear of. No true estimate can be formed of the number of certificates that would thus be received, but fairly accurate diagnosis of even 20 per cent. of the total fatalities would be of inestimable value. No hardship could possibly be inflicted on anyone by this system, and an annual increase in the number of certificates could surely be anticipated.

ABSTRACT OF THE REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1899-1900.

(*W. L. Harvey, Esq.*)

Public Works.

Special Drainage.—Several works under this head remained unfinished at the close of the year, and some other works were commenced during the year.

Some difficulty was experienced in connection with the laying of the 16-inch main from DeLima Street to Frere Road, as it had to pass under a number of sidings in the Wari Bunder Goods Yard, but these were overcome and the following Resolution, No. 6718, was passed by the Corporation :—"That the Commissioner be informed, with reference to his letter No. 14608, dated the 7th September, 1899, regarding certain sewage mains which have to pass under the Wari Bunder Goods Yard and sidings, and the Masjid and Carnac Bridge sidings of the G. I. P. Railway, that the Corporation approve of his giving an undertaking to the Railway to the effect that should the pipe in or near the Railway crossing burst, causing damage to the line and works or serious detention to traffic, the responsibility of such mishap would be accepted by the municipality, except in the case of any damage to which the Railway Company may have contributed." The work was started, the municipal contractors, Messrs. Richardson and Cruddas, being employed by the Railway Company as their own.

The services of Mr. Santo Crimp, the drainage expert, were obtained for the purpose of reporting on the Drainage of Bombay and advising the Corporation thereon. His report was printed and circulated to the Members of the Corporation about the middle of November.

The machinery at the Air Compressor Station and several Ejector Stations has worked satisfactorily during the year. There was a considerable decrease in the quantity of sewage, due to the deficient rainfall.

Pumping Station at Love Grove, Worli.—The Worthington Engines at this Station worked satisfactorily throughout the year. Fortnightly observations showed the efficiency of the pumps to average 91·76 per cent. The conversion of the old engine house into a shred lifting chamber, office and godown, was efficiently carried out at a total cost of about £1,122.

House Connections.—The streets portions of the House Drainage Connections were partly carried out by contract and partly departmentally. The number of connections made was 1,086, costing about £2,780.

WATER WORKS. *Tansa Lake.*—The rainfall for 1899 was 40·07 inches, that for the two preceding years being 98·68 and 104·82 inches, respectively. The total quantity of water received into the lake was estimated at 12,714 millions of gallons or about 45 per cent. of the total rainfall. One burst on the 48-inch main necessitated the water being shut off for thirty-one hours. Considerable progress has been made with the repairs to the embankments.

Vehar Lake.—The rainfall for 1899 was 35·26 inches, that for the two preceding years being 94·51 and 97·36 inches respectively. The total quantity of rain which fell in the drainage area was about 3,060 millions of gallons ; of this about 1,160 millions of gallons, or 38 per cent., reached the lake, as compared with an available total of nearly 6,000 millions of gallons. Notwithstanding the failure of the monsoon it was not found necessary to restrict the quantity of water drawn from this lake. One burst occurred on the 32-inch main and one on the 24-inch main during the year.

Tulsi Lake.—The rainfall for the year 1899 has been 43·80, representing a total fall of about 1,647 millions of gallons ; of this about 356 millions of gallons, or 22 per cent.,

were received into the lake as compared with 111·6 inches in the previous year, yie an available supply of 2,670 millions of gallons, or 62 per cent. There was one bur the 24-inch main causing the water to be shut off for about 12 hours.

Miscellaneous Works.—A 4-inch metered branch for supplying water to the Kut Siding has been made, but no other extensions have been made during the year. revised scheme for the extension of mains has been sanctioned by the Corporation.

Distribution and Maintenance.—The number of bursts on various parts of the sys during the year was 131. The net increase in the number of connections exclusive those made to Health Camps has been 217. The annual growth in the number of conn tions for the past three years has been 0·5, 1·8, and 1·0 per cent. respectively. The work of examination of mains by Deacon's meters shows them to be in a satisfactory condition.

Public Health.—The state of the public health during the year has not been satisfactory. The total mortality for the year under report, exclusive of still-born, was 56,434, being the highest mortality ever recorded for the City of Bombay, the average mortality of the previous five years having been exceeded by 17,785.

On an average 5,775 men and women, 1,124 scavenging and drain carts and 205 night-soil and cesspool carts were at work each day. 344,268·5 tons of garbage, equal to 943·2 tons a day, were collected, removed and disposed of, against 388,816·75 tons of garbage in 1898. 170,506·11 tons of night-soil and cesspool matter, equal to 467·14 tons a day, were collected and removed, as against 169,586·9 in 1898. 167·1 miles of covered drains were opened and cleaned, against 172·1 miles in 1898.

The most noteworthy feature in the work of the Department has been the completion of the scheme for the removal of the city refuse by rail to Deonar and Chembur. The removal is effected twice daily by a train of 25 waggons. The loading of the trains is effected at a loading siding upon municipal land at Mahalaxmi, the refuse being tipped directly from the Health Department carts into the waggons. The system has worked smoothly.

The ground reclaimed by the municipality at the Tardeo Flats has been handed over to the City Improvement Trust. The working of the Garlic Incinerator at the municipal workshops was stopped on the 20th November, 1899, partly on account of complaints against the smoke caused by it, and partly because it stands upon ground claimed by Government.

On the 1st January, 1900, the first step was taken towards improving the system of registration of births and deaths. A District Registrar now resides in each ward and the Deputy Health Officers now perform the duties of the old registrars.

There were 15,796 deaths from Plague, being 2,389 less than in the last year. Plague measures have been carried out by a separate branch of the administration working directly under the Deputy Commissioner for Plague operations.

In addition to the Municipal Dispensary, which was opened in 1898 at Kumbharwada, another was opened on the 22nd January, 1899, at Dongri. They are both free and the attendance has been large.

An Act dealing with the adulteration of ghee came into operation during the year. Several prosecutions were instituted by the Health Officers, resulting in convictions in most instances.

The flushing of house gullies was carried out during the dry weather by means of seven steam flushing engines.

ABSTRACTS OF THE REPORT OF THE ACTING HEALTH OFFICER OF BOMBAY CITY FOR 1899.

(*J. Leask Esq.*)

It would have been better if the late Health Officer, Col. T. S. Weir, I.M.S., had been able to prepare this Report; but as he was recalled by Government to take up a high administrative appointment in the Military Department, he retired from the service of the Municipal Corporation on the 26th of June, 1900, there was therefore no opportunity for him to prepare it before his departure. As I have been appointed to the office temporarily, it is only possible for me to submit a few general remarks, and to compare the mortality and birth statistics with those of the previous years.

The total mortality for the year 1899, exclusive of still-born, was 56,434, the highest mortality which has ever been recorded for the City of Bombay. In 1898 the mortality was 51,961, or 4,473 less than the year under report. Taking the average of the previous five years, the mortality in 1899 was 17,785 more.

The rainfall registered at Colaba Observatory for the year was only 35·90, a little less than half the normal quantity. The heaviest rainfall was registered in June, viz., 20·81. In July the rainfall was only 4·72, in August 5·23, and in September 3·49 inches were registered. The rains practically ceased about the middle of August. The following is the rainfall for the previous three years:—1896, 87·65; 1897, 81·53; 1898, 74·09. From this it will be noticed that there has been a gradual decrease, culminating in the practical failure of the rains in 1899.

The temperature in April, May, June, October and November was high.

The most noteworthy feature in the working of the Health Department has been the completion of the scheme for the removal of the City refuse by rail beyond our boundaries. The Municipality purchased a large area of land at Deonar and Chimbur, having an area of 823 acres, and the refuse is now transported daily by rail to this place. Loading sidings have been constructed upon the municipal land at Mahalaxmi, and here the refuse is tipped from our carts into the railway wagons. At present two trains of 25 wagons each have been run daily.

Registration.—On the 1st of January, 1900, the first step was taken towards the improvement of birth and death registration. Each ward of the City has now resident within its boundary a District Registrar. The Deputy Health Officers now perform the duties of the old Registrars. As has been frequently pointed out in the Annual Reports of the Health Officer, it will not be possible to obtain an accurate system of death registration until the production of a medical certificate of the cause of death is made compulsory. I trust that the necessary amendments in the Law will be made when the new Municipal Act is being considered.

Plague Administration.—Plague measures throughout the year have been carried out under your orders by a separate branch of the Administration, working directly under the Deputy Commissioner for Plague operations. The Health Department have given all the assistance possible to the officers entrusted with this special work in each ward. Men of the Health Department collected great numbers of rats in different parts of the City. They are paid half an anna for each rat. The Port Trustees and the Railway Companies took special measures for the extermination of rats.

Water-supply.—Owing to the deficient rainfall, the lakes supplying the City did not fill as usual, and in consequence the water was not all of good quality, the Tulsi supply in particular being impure. There was much vegetable matter in suspension. The various waters have been subjected to constant and close chemical and bacteriological examination. In January, 1900, it was deemed advisable to issue a public notice about the state of the water, and the people were advised to boil it, as an easy and effective way of purification.

Fevers.—During the year the prevalence in many parts of the town of an in[illegible] type of fever was noticed. Colonel Weir was of opinion that the fever exhi[illegible] symptoms of the type known as "Malta fever," and this view is supported by the opini[illegible] of several local practitioners, under whose observation many of the cases came. The ty[illegible] of fever was different to that usually prevalent in Bombay; the duration of the fever w[illegible] prolonged; there was great pain in the body, and the attack was not amenable to t[illegible] usual treatment. I notice that a similar type of fever has been prevalent at Simla th[illegible] year, and investigations gave results exactly similar to "Malta fever." These obscu[illegible] forms of fever are, apparently, difficult of diagnosis, and their nature could only b[illegible] decided after prolonged enquiry and examination by experts. It may also be noted tha[illegible] in the Thana Collectorate, malarial fevers were much more prevalent than in the previou[illegible] year. Relapsing fever has unfortunately continued throughout the year; and in th[illegible] light of investigations now being carried out by Dr. Cayley and Dr. Christy at th[illegible] Municipal Laboratory at Parel, it is apparent that many of the deaths which have beer[illegible] returned as remittent fever, were in reality relapsing fever. Blood specimens were[illegible] taken from amongst the patients attending the Dongri Dispensary, and microscopica[illegible] examination showed the spirillum of relapsing fever. A serious development of this[illegible] disease occurred in the common jail.

The failure of the rains throughout the Presidency induced abnormal seasonal[illegible] conditions which seriously affected the public health. Fevers and diseases of the bowel[illegible] were abnormally prevalent. Famine conditions in the Mofussil caused the poor to floc[illegible] towards Bombay, and I think there can be no doubt that, irrespective of local conditions[illegible] the increase of population by the incoming of starving people, accounts, in some measure[illegible] for the increased mortality of the year.

Lustig's Serum.—The preparation of Professor Lustig's Plague Serum continued throughout the year at the Municipal Laboratory at Parel, under the able direction of Dr. G. Polverini. The results of the action of the serum will doubtless be dealt with in the report of the working of the Arthur Road Hospital.

Drainage.—So much has been written by the Health Officer in previous Annual Reports, that it would be needless for me to refer at any length to this all-important subject; but I would urge again the necessity for the drainage of Malabar Hill being proceeded with. Many new buildings have been erected on Malabar Hill, and beyond the avoiding of certain of the the old storm-water side gutters, nothing has been done in the way of drainage, and it is possible that the recent prevalence of a peculiar type of fever, which was not confined to one place on the Hill, was connected in some way with conditions arising from polluted soil.

The works in connection with the Mazagon gravitation system of drainage should be carried out with all speed. The cesspool nuisance in Mazagon, which has existed for many years, causing serious danger to the health, and inconvenience, of the people, must continue until drainage connections are made.

Drainage of the northern part of the island, with the extension of population in that direction, will soon become an urgent necessity. Serious nuisances already exist in places owing to absence of drainage, and it is hopeless to attempt to abate these nuisances by the construction of cesspools, and the consequent provision of cesspool carts and an army of cesspool men. Drainage is the only way of relief.

The City Improvement Trust have got a scheme for the opening out of the suburbs to the north of Dadar. It will take years, however, before any scheme could be carried out, and in the meantime the question is, what is to be done in regard to the drainage of this part of the City? It seems to me desirable that a scheme of drainage should be worked out which would fit in with the proposals of the Improvement Trust, as it would be absolutely necessary to have an efficient system of drainage in progress before any extensive building operations take place.

The latrines which have been erected in Colaba are intended to serve groups of houses which have no accommodation of their own, and for which accommodation could not be provided without partial demolition of the buildings. The occupants of these houses made use of public latrines which were erected by the municipality so far back as 1866.

The completion of the Shone system of drainage in Colaba made it possible for the municipality to provide public conveniences of an improved type.

Plague Mortality.—The total number of Plague deaths registered during the year was 15,796, giving a death-rate, on the census population of 1891, of 19·22 per 1,000. In 1898 the mortality from Plague was 18,185 and the death-rate was 22·12. Whether this

n in mortality is only apparent or is really an indication of the gradual cessation e visitation it is impossible to say. Plague has many obscure forms, and it is probable that a large number of deaths attributed to other causes were in reality caused by gue. The city was very full during the year, and I should think the population was ry little short of the normal. As in previous years, the general Hindu community, hich form one-half of the total population, suffered severely, the mortality among this ss being 10,987. There is a notable decrease amongst Jains, Bhatias, Mahomedans d Parsees. Europeans show 12 cases as against 15 of the previous year.

There is a marked reduction in the number of plague deaths occurring in Fort, North, Market, Dhobitalao and Kumbharwada, whereas an increase is shown from Middle and Lower Colaba, Tarwady, Sewri, and Mahim. The increase in Tarwady is due to the fact f there being hospitals and segregation camps in the section. The increase in Mahim is o doubt due to movement of population. The incidence in the other sections shows very ittle difference as compared with last year. Byculla returns 1,440 deaths as against ,432 of the previous year.

A total of 11,026 plague deaths occurred amongst males and 4,770 amongst females, he age-period of males showing the highest death-rate was from 30 to 39 years. Amongst emales the highest death-rate occurred between 10 and 14 and 30 and 34 years.

General Mortality by Causes.—Plague unfortunately again stands the highest, the rate eing 19·22 against 22·12 in the previous year. There is also an increase in phthisis and iseases of the respiratory system, measles and diarrhœa. There was also a considerable ncrease of deaths from fevers. The number of deaths from cholera was 111 as against 104 of the previous year.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM DIFFERENT CAUSES IN 1899.

Cause of Death.	No. of Deaths.	Death-rate per 1,000 of Population.
Small-pox	440	·53
Measles	1,868	2·27
Fevers	5,063	6·16
Cholera	111	·13
Plague	15,796	19·22
Phthisis	6,029	7·33
Diseases of the Nervous System	3,012	3·66
Do. Respiratory System	8,650	10·52
Diarrhœa	2,529	3·10
Dysentery	1,757	2·13
Accidents	547	·66
All other Causes except Still-born	10,632	12·93
Total	56,434	68·67

Amongst persons born in Bombay 16,522 deaths were recorded during the year, and amongst those born outside Bombay 37,797. This marked difference shows very clearly how varied our population is.

Leaving out Negro-Africans, Buddhists and Lingayets, who form very small communities in the population, low-caste Hindus shows the highest mortality, viz., 131·12 per 1,000. The Jain community, which includes Baniahs also, suffered severely, their death-rate being 75·16. Mussulmans give a death-rate of 73·21, and the general mass of Hindus give a death-rate of 68·95. The death-rate amongst Parsees was 34·89, being considerably lower than in the previous year. The Parsee community, to a great extent, took advantage of inoculation, and the reduction in the death-rate may very probably be due to this. The European death-rate (16·47) was lower than in the previous year. This is remarkable, as it is the lowest death-rate since 1894. I believe there has been an increase in the number of the resident European population within the last few years.

33,340 males and 23,094 females died during the year, excluding those under five years. The highest number of deaths amongst males occurred in the age-period between 30 and 34 years, 3,756 deaths having been registered; and amongst females, 3,479 in the age-period of 60 and over.

The infantile mortality can only be called appalling, a little less than ¼th of t[illegible] mortality being of children under five years of age, and the greatest mortality of any [illegible] is that of infants under one year. The increase in the infant mortality is over 3,00[illegible] more than in the previous year. I think it must be put down in great measure to th[illegible] famine and abnormal conditions which prevailed during the greater portion of the ye[illegible] and the inability of weak and devitalized mothers to afford natural nourishment to the children.

The following are the sections showing the highest mortality:—Mahim, Byculla, Parel 2nd Nagpada, Tardeo, and Kamathipura. The very high incidence in Mahim, 111·13 where there is no crowding of buildings and density of population, can only be attributed to the movements of population, consequent upon plague. Byculla shows a very high death-rate; last year the rate was 88·68, but this year it is 104·97. The densely crowded sections of Bhuleshwar, Khara, Talao, Khumbharwada, Fanaswady, Dhobi Talao and Market show a death-rate ranging from 43·83 to 76·31, leaving out Fort South, which residentially is a small quarter. Walkeshwar has the lowest death-rate, viz., 23·86. In the last annual report Col. Weir has described very fully the causes, viz., over-crowding, imperfect ventilation, and poor living, which exercise the greatest influence on mortality in any of the classes. It is hopeless to prevent over-crowding amongst the poor. Customs of caste, dearness of food, the economic conditions of labour, all tend to induce over-crowding. Over-crowding amongst the poor is not confined to Bombay. It is one of the greatest sanitary problems in all large cities, and is one of the most difficult to deal with in anything like a practical manner. We may hope, however, that the work of opening up the city, now being carried forward by the City Improvement Trust, and the improvement of insanitary buildings now being done by the municipality, will have the most beneficial effect on the general health of the city.

Cholera.—The mortality from cholera was 111, being seven more than last year. The month of highest mortality was March, and Parel and Worli gave the highest number of deaths. Of the total number of deaths, 92 occurred amongst Hindus of other castes. A total of 15 deaths occurred amongst persons who had been resident for three months and under, and eight deaths amongst persons resident for six months and under. The greatest number of deaths occurred amongst persons born outside Bombay.

Fevers.—A total of 5,063 deaths was registered from fevers, being 949 more than in the previous year. As in the last year, remittent fevers claim the highest figures, viz., 4,761, being 1,045 more than last year, but 710 less than the average of the previous five years. To simple continued fever 144 deaths were put down, being 115 less in the last year, and 652 less than the average. Enteric fever shows 44 deaths, being seven more than in the last year, and 11 more than the average. To ague 114 deaths were ascribed, being 12 more than in the last year, but 126 less than the average. I think it is extremely probable that a large proportion of the deaths ascribed to remittent fever were due to plague in some of its obscure forms. It is also probable that some of the cases were due to relapsing fever, which is difficult of diagnosis without microscopical examination of the blood. Taking the fever mortality by months, it rose and fell with the mortality from plague. It rose gradually from January to March, when 762 deaths were registered. March, it being remembered, was the highest month of plague mortality, as well as the highest from all causes. Fevers gradually decreased until June, and then gradually rose right on to the end of the year, 610 deaths being registered in December. The course of fevers during the year ran with practically the same fluctuations as in the previous year. Amongst the Hindus of low-caste there was a considerable increase, the rate being 14·61 as against 6·90 in the previous year. There was also an increase among the general Hindu community. Mussulman mortality was almost the same as in the last year. Parsees showed a slight decline, and Europeans a slight increase. The suburban sections of Parel (12·52), Mahim (11·67) and Worli (11·21) give the highest incidence of fever mortality, Parel section, as in 1898, being the highest. The high fever mortality of the suburbs is no doubt attributable, in a great measure, to the absence of drains to carry off sewage and subsoil water.

To relapsing fever 829 deaths were due, being 283 more than in the previous year, and one-fourth of the number being registered in March. From April the disease rapidly declined, but again rose in December.

Measles.—There was a great increase in the mortality from measles, 1,868 deaths being registered, being 1,614 more than in the last year, and 1,431 in excess of the average of the last five years. As in former years, the greatest number of deaths occurred amongst

Hindus of other castes, and the Hindu low-caste give the highest death-rate. As before, the infant mortality was the highest, and the age period under two years the most fatal. The female death-rate was much higher than that of the male.

Phthisis.—Phthisis again claims a large proportion of the total mortality, 6,029 deaths having been registered, being 405 more than in the previous year, and 1,317 more than the average. The small community of Negro-Africans gives a very high death-rate of 57·53. This community, however, is a fluctuating one. The Mussalman mortality was very high, though a little less than in the previous year. The death-rate amongst Jains and Brahmins was a little lower. Amongst Europeans and Parsees the death-rate was stationary. Only six deaths amongst Europeans were registered. 2nd Nagpada was again the most unhealthy section. Umarkhady was next, and Byculla followed. In the Byculla section there is an increase in the population. The 2nd Nagpada has long been a most unhealthy locality, and it is satisfactory to note that the City Improvement Trust have taken up this district as the first requiring improvement. There died 2,858 males and 3,171 females from this disease. The most fatal period of life amongst males was over 60 years, and amongst females between 30 and 34 years. The female death-rate is nearly double that of the male.

Small-pox.—The deaths from small-pox show an increase, 440 deaths being registered in the year. This was 385 more than in the past year and 117 more than the average. Hindu low-castes suffered the most. There were no deaths amongst Europeans or Jews, and only four deaths amongst Parsees. The section showing the highest mortality from small-pox was Worli, Sewri and Mahim followed. The disease was practically confined to children below the age of five years. It was worst during the first year of life.

General mortality.—From diseases of the digestive system 5,559 deaths were registered, being 957 more than in the last year, and 1,964 more than the average. Diarrhœa and dysentery show a marked increase both as against last year and on the average. There were 3,012 deaths registered under the diseases of the nervous system, being 435 more than in the last year and 725 more than the average. There were 8,650 deaths ascribed to diseases of the respiratory system, being 227 more than the last year, and 2,337 more than the average.

Births.—10,624 living and 1,955 still-born births were registered, being 160 less than in the last year; of these 5,661 were males and 4,963 females. Taking the proportion of males to females, according to the census of 1891, at 170·60 to 100, and assuming that there were 100 females to 100 males, the birth-rate would be equal to 22·04. As explained in the last Annual Report, the birth-rate is affected by plague. It may be noted that the Parsee birth-rate was lower than in the last year, and the Musalmans' rate also shows a decrease.

APPENDIX.

No. 1.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1899.

1. According to the report of the Meteorological Department, the rainfall of the whole of India fo the whole year was in defect by 11·14 inches. The season, taken as a whole, was dry and hot. Th rainfall, besides being deficient in quantity, was irregularly distributed. Whilst the fall, mor especially on the eastern side of India, was in some parts in excess, it was greatly in defect i Western India. The exceptional dryness of the year doubtless conduced to lessened sickness o malarial origin.

2. The average strength of the *European Army of India* was 67,697, or less by 44 than in th previous year. Its health, judging from the lower ratios of admissions into hospital, constantly sick deaths, and invaliding, was much better than in 1898. The chief causes of admission into hospita were, again, venereal diseases and ague, although under both heads the returns show a very marked decrease in the year under report as compared with 1898; the admission rate due to ague having fallen from a ratio of 394·0 per thousand of strength to 235·2, and that due to venereal diseases from 362·9 to 313·4. Venereal diseases caused 27 per cent. of the total sickness of the year, and ague 20 per cent., or, between them, 47, as compared with 52 per cent. in 1898. The two chief causes of death were, again, enteric fever and hepatic abscess; the former accounting for 40 per cent. and the latter for 10 per cent. of the total deaths, as compared with 51 per cent. and 8 per cent. in the preceding year. Malarial fevers and venereal diseases, to which the highest ratios of total admissions and total sickness were due, were also the chief causes of invaliding. Of the 2,142 cases of invaliding, 417 were due to secondary syphilis and 229 to ague. As a cause of invaliding "debility" is given the next place with 196 cases. No other disease accounted for as many as one hundred cases of invaliding.

3. Of the four *Commands*, Madras again records the lowest mortality rate, but the highest constantly sick and admission rates. The Punjab Command also again records the highest death-rate, although this has fallen from 27·63 per thousand of average of strength to 14·82, or to nearly half of that recorded in the previous year. Enteric fever, the incidence of which largely determines the relative mortality in the several Commands, was most fatal in the Punjab, and least fatal in the Madras Command; in the former the ratio of deaths ascribed to it was 6·64 per 1,000, and in the latter 3·03, or less than half. Pneumonia and other lung affections were also most fatal in the Punjab, and least fatal in the Madras Command; in the former the death rate from pneumonia was 1·16, and in the latter only 0·16. All of the Commands were healthier than in the previous year.

4. Of the *Geographical groups*, Burma Coast and Burma Inland had death-rates from all causes of 6·63 and 7·82 respectively. These were the lowest recorded. On the other hand, Bengal-Orissa group had a death ratio of 21·87, the highest recorded. The European garrison in each of these three groups was comparatively small, in none of them numbering three thousand men. The Upper Sub-Himalaya group with the largest garrison, numbering upwards of twelve thousand men, recorded a death-rate of 14·12; and the Deccan, with the next largest garrison of close on ten thousand, recorded a death-rate of 9·56. The two groups with the lowest death-rates from all causes had a low mortality from enteric fever; but the Bengal-Orissa group with the highest death-rate records a ratio of only 1·90 from enteric fever; dysentery and hepatic abscess in this latter group accounted, between them, for a mortality ratio of 8·56 As usual, the Western group returns low admission and death rates; its death-rate of 1·86 from enteric fever is the lowest recorded except that for Burma Inland, and its death-rate of 9·31 from all causes is lower than any other, except the rates for Burma Coast and Burma Inland; its admission rate is also the lowest but one. The strength of the garrison of the Western Coast was, however, only 1,611. Too much importance need not be attached to these figures as evidence of the comparative healthiness or unhealthiness of the different groups. The ratios of sickness and mortality recorded for any given group or station might be largely influenced by conditions affecting the men sent to garrison it, such, for example, as their ages and length of service in India, previous exposure on field service, or in camp during epidemics. Obviously, it might be misleading to deduce conclusions regarding the healthiness of geographical groups or stations from ratios of sickness and mortality dependent on conditions not connected with these groups or stations.

5. Of the larger *stations* with garrisons of over 1,000 men, Peshawar, Lucknow, Umballa and Bangalore return the highest death-rates. All of these, except the last, were amongst the stations which recorded the highest death-rates in the previous year. The death-rate of Bangalore, which was only 10·64 in the previous year, has risen to 17·35. Increased mortality from enteric fever had a considerable share in bringing about this result, the death-rate from this disease having risen from 4·26 in 1898 to 7·43 in the year under report. Quetta affords a good example of the influence which

[redacted]c fever may exercise on the death-rate of a station. In previous year's *memorandum* Quetta was [redacted]tioned as one of the large stations recording a high death-rate. In 1898 this rate was 44·43; in [redacted]e year under report it was only 10·30. In the preceding year enteric fever by itself accounted for a [redacted]ath-rate of 35·08, or more than three times the death-rate from all causes in the year under review, [redacted]hen the enteric fever death-rate was only 2·08 per thousand of the strength of the garrison. In [redacted]eshawar the enteric fever death-rate likewise decreased from 24·48 in the preceding year to 9·87 in [redacted]he year under review; and in Umballa from 13·19 in the former year to 8·97 in the latter.

6. Of *regiments*, the 7th Battery, Eastern Division, Royal Garrison Artillery, and the 72nd Battery, Royal Field Artillery, recorded the highest death-rates; the former 71·43 and the latter 68·70 per thousand of strength; but the average annual strength of the one battery was only 14; so that the occurrence in it of a single death gives the high ratio recorded; whilst the strength of the other battery was only 131. The Royal Irish Rifles, with a strength of 716, had 30 deaths, equivalent to a death-rate of 41·90 per thousand of strength. This regiment arrived from Natal on the 16th of April and suffered severely from dysentery, hepatic abscess, intermittent and enteric fevers.

7. Having dealt with sickness and mortality in relation to India, to Commands, to Geographical groups, to Stations, and to Regiments, the Report proceeds to discuss the statistics of some of the chief diseases. Of the three diseases first dealt with, *cholera, small-pox, and influenza*, little need be said. Only a single death was due to each of them. In no previous year have the recorded admission and death-rates from cholera been so low: only one case, a fatal one, of the disease having occurred. Of small-pox there were 14 cases with one death: all the men attacked are stated to have borne vaccination marks. Influenza was the cause of a considerable amount of sickness but of only one death. The total number of cases of this disease during the year was 674; and of these by far the greater number occurred in the months of March, April and May.

8. *Ague* gave rise to just over 20 per cent. of the admissions from all causes: this was less, however, than the percentage in the previous year, when it was 27. The number of deaths ascribed to ague was 19 in each year, but the ratio of deaths was somewhat lower in the year under report than in the preceding year, having been in the former ·28 and in the latter ·30. "The lowness of the ratio was probably connected with the dryness of the year." The Bengal-Orissa group suffered most, and Hill Stations and Western Coast suffered least from ague. In the first of these groups the admission rate was 658·1 per 1,000 of strength, and in the two last 103·6 and 148·4 respectively. *Remittent fever* was much less fatal than in the previous year, only 11 deaths having been attributed to it as compared with 24 in 1898. The exact diagnosis of remittent fever continues to be far from easy. "At Barrackpore cases suspected of being enteric, but not reacting to Widal's test, were returned as remittent fever, even though they did not respond to the exhibition of quinine." In the diagnosis of *simple continued fever*, also, difficulty seems to have been experienced. "Some of the cases were suspected to be enteric fever, or malarious fever, or influenza, or Malta fever, or some yet undifferentiated form." Those who have themselves seen much of fever in India will be the first to acknowledge that, in practice, the differentiation of the several forms of the disease is sometimes a matter of exceeding difficulty, and the larger the experience a medical officer has had of Indian fevers the more tolerant is he likely to be of opinions regarding them which may not coincide with his own. Of the causes of simple continued fever mentioned are sun, heat, over-exertion, want of acclimatisation, especially when these are combined; chill, exposure, constipation, errors in diet and drink. "From 1886 to 1894, while simple continued fever was on the whole falling, ague and enteric fever were on the whole rising." In briefly noticing Malta fever the Sanitary Commissioner issues a word of warning. He says that just at present a number of cases of this description of fever are being discovered in India both among Europeans and natives, and adds:—"but the experience of the past should warn those in authority, while encouraging the research, to exercise a certain amount of reserve in the acceptance of at least the earlier results. After all, serum diagnosis is only in its infancy, or is just emerging therefrom."

9. The returns of *enteric fever* for the year might lead to the expectation that the prevalence and fatality of this disease in the European Army of India had at length received a definite check. In 1898 there were 2,375 admissions and 654 deaths due to it: in the year under report there were 1,392 of the former and 348 of the latter. The admission rate fell from 36·9 to 20·6, and the death ratio from 10·17 to 5·14, a percentage reduction of 44·17 and 49·46 respectively. Had so marked a reduction been the result of the discovery of more effectual methods of preventing enteric fever there might have been room for hope that the reduction would be maintained, or even carried to a lower point in the future. But such hope would be premature. The reason of the reduction "is to be found, perhaps, not so much in the climatic conditions of the year as in the facts that the influx of drafts from England was much smaller than usual, and that there was no field service." Seeing that the liability to die of enteric fever during the first year of residence in India is greater than in any subsequent year, it is evident that, if for any year the supply of drafts of young soldiers from Europe is cut off or reduced, there will be a corresponding reduction in the number of men especially susceptible of contracting the disease. Similarly when, after having been temporarily interrupted, the sending out to India of drafts of young soldiers shall have been resumed, there is reason to fear that sickness and mortality from enteric fever may again rise in proportion to the number and youth of the men so drafted. The history of enteric fever in the year under review only further confirms what the records of each succeeding year so clearly demonstrate: that "the relative liability to death from enteric fever was greatest in the age period 20-25, and in the first year of residence." But age and length of residence in India are not the only conditions which influence the prevalence of this disease. The history of enteric fever in Quetta during the two consecutive years 1898 and 1899 may be cited as an illustration of this. During the former of these years, in a European garrison of the average strength of 2,138, the admission rate from enteric fever was 108·3 per 1,000 of strength, and the death-rate 35·08. During the year under report, in a garrison of the average strength of 2,405, the admission rate from enteric fever was 10·8 per 1,000 of strength, and the death-rate 2·08. "This

great reduction at Quetta may fairly be considered, at least provisionally, as due to the detailed painstaking measures adopted in consequence of the outbreak in 1898, though it will be noticed the season of maximum prevalence was the same in both years. The number of fresh men arriving in drafts was much the same as in the preceding year." In this case at least the decrease could not be credited to the supply of susceptible materials having been shut off. A footnote added to the Report states that : "There has been an outbreak again in 1900," a somewhat disappointing sequence to the adoption of the measures which appeared to have had a decided effect in checking the progress of the disease. The Report again gives an excellent *résumé* of the latest additions to the literature of enteric fever. To this must be referred those who wish to know what is being done to extend our knowledge of the disease. The subject can be no more than touched upon here without unduly lengthening this *memorandum*. The general tendency of recent research is to show that the bacillus of enteric fever is widely disseminated throughout the organism of the individual who is the subject of it. "Any conception of the disease which regards it as merely affecting the alimentary canal only can no longer be maintained. On the contrary, so far from considering it an intestinal disease pure and simple, we should rather look upon it as a *modified form of septicæmia*." In all cases the bacillus passes into the blood, by means of which it is distributed to the most diverse organs. Outside the body its diffusion seems likewise to be wide. From a perusal of the abbreviated reports submitted by medical officers for 1899 may be gathered some idea of the variety of the suggested sources of enteric fever infection. The number of those who adhere to the "solely water-borne" theory of infection seems to be decreasing. The results of some of Hankin's examinations of the specimens of water sent to him for report seem somewhat remarkable. "The enteric microbe was detected in one out of four specimens of water that were stated to have been treated with permanganate and boiled." And :—"the results obtained in the year under review appear to confirm my opinion that the enteric microbe is one that flourishes better in comparatively pure than in very polluted water." The detection of the enteric fever microbe in water is far from easy ; experts, it may be remembered, failed to find it in the water supply of Maidstone during the prevalence of the recent great epidemic of enteric fever at that place, although there was a pretty general concensus of medical opinion that the disease had its origin in, and was disseminated by, the water.

10. The European Army of India suffered rather severely from *scarlet fever*. There were altogether 83 cases of the disease with six deaths. Indigenous scarlet fever is rare amongst the natives of India, and the different outbreaks of the disease amongst the troops appear to have been due in most part, if not altogether, to the importation of infection. The transport "Simla" was, perhaps, the source from which infection in all, or nearly all, the Indian cases of 1899 was derived.

11. There were 211 admissions, with 38 deaths, from *tubercle of the lungs*, as compared with 196 of the former and 37 of the latter in the previous year. The Sanitary Commissioner remarks that the annual reports for stations where tubercle occurred in greatest proportion throw no light on the subject.

12. *Pneumonia* was accountable for 340 admissions and 40 deaths, as compared with 190 of the former and 38 of the latter in 1898. As usual, the disease was most prevalent in the north-west of India, and in the cold weather. "The five men who died at Peshawar were all more or less debilitated by previous attacks of ague, and in each case the fatal illness developed after the man's participation in the fatigues of route-marching."

13. The unusual dryness of the year was probably connected with the decrease in the prevalence and fatality of *dysentery* and *diarrhœa*. Whilst the admission rate in the case of the former disease fell from 30 to 25, and the death-rate from ·78 to ·65, per 1,000 of strength, the admission rate in the case of diarrhœa fell from a ratio of 27 to 18, and there was no death due to it. Dysentery was most prevalent, as usual, in the Bengal Command, and in the Bengal-Orissa group.

14. From *abscess of the liver* there was a reduction in the number of deaths from 102 in the preceding year to 85 in the year under report ; but in addition to these 85, abscesses were also found in the liver after deaths attributed to several other causes. Of these additional cases in which *post-mortem* examination revealed the presence of hepatic abscess, the cause of death in 11 was returned as dysentery, and in five as enteric fever. The mortality from abscess of the liver was 32 times more frequent during the year among European than among Native soldiers.

15. The decrease in the admission rate from *venereal diseases* in the European Army of India during 1899 is a continuation of that which began in 1896. In 1895 the rate had attained a maximum of 522·3 per 1,000 of strength. From this it fell slightly in 1896 to 511·4 ; and in the following year, more considerably, to 485·7. In 1898 the decrease was marked, the rate falling to 362·9, or in a single year by 122·8. Decrease has been maintained in 1899, although at a less rapid rate than in the preceding year. In 1899 the recorded admission rate was 313·4, or less than the rate for 1898 by 49·5. In addition to the causes mentioned as probably conducing to reduction of the admission rate in the previous year, a list of others is given in the Report of the year under review. Of the latter, those which were perhaps most likely to have been attended with good results were measures which had for their object to lessen the opportunities for soldiers consorting with loose women by keeping the latter away, the effect of cantonment hospitals, constant examinations and surprise inspections of the men, presence of an energetic cantonment magistrate, and hospital stoppages. There were 14 deaths and 442 invalidings directly due to venereal disease against 17 of the former and 569 of the latter in the previous year.

16. The *Native Army* shared with the European Army in the improved health of the year. Its average strength was 128,529. The admission ratio which had fallen in the previous year from the decennial average of 917 per 1,000 of strength to 816 fell still further to 705, and the constantly sick ratio from 33 to 28 ; whilst the mortality ratio, exclusive of absent deaths, fell from 11·07 to 10·70. Ague was the chief cause of admission into hospital, and of itself accounted for 37 per cent.

total admissions; whilst the chief causes of death were pneumonia and remittent fever—monia having been accountable for 36 per cent. and remittent fever for 11 per cent. of the total aths. As usual, the Native soldier suffered far less than his European comrade from enteric fever d venereal disease, but more from influenza, cholera, dysentery, and respiratory diseases, especially eumonia.

17. The highest constantly sick rate in the Native Army was in Assam, the highest admission te in Bengal-Orissa, and the highest death-rate in the Hill Stations. Of the stations with garrisons a strength of not less than 1,000, Edwardesabad returned the highest death-rate of 28·04, a rate, owever, much below that of the previous year, when it was 40·61. Next follow Belgam and eshawar with death-rates of 22·85 and 18·55 respectively, both stations returning higher rates than 1898. It is stated in paragraph 41 of the Report that the principal cause of death in these stations as pneumonia, but, so far as Belgam is concerned, plague and not pneumonia would appear to have used the greater number of deaths; to the former 21, and to the latter only three deaths were due.

18. Instead of diminishing, in sequence to a year of high prevalence, in accordance with what its revious behaviour would have led one to anticipate, *influenza* increased in severity. The number f admissions due to it rose from 1,047 in the previous year to 1,586 in the year under review, and he deaths from four in the former to 13 in the latter.

19. From both *cholera* and *small-pox* the Native suffered more than the European Army. Of the former of these diseases there were 126 cases with 68 deaths, as compared with a single case in the European Army; whilst of the latter there were 46 cases with two deaths among the Native troops as compared with 14 cases and one death among the European troops. The Native garrison of Peshawar suffered most from small-pox; the disease prevailed in severe epidemic form in the city and district of Peshawar amongst the civil population.

20. *Ague*, although it caused nearly 37 per cent. of the sickness in the Native Army, was, probably owing to the dryness of the year, considerably less prevalent than in 1898. There was also a decrease in the admission rate from remittent fever, although an increase in the death-rate due to it. Remittent fever was of itself responsible for 147, or 11 per cent., of the total deaths in the Native Army.

21. As a cause of sickness and mortality enteric fever is of comparatively slight importance amongst the Native troops. Altogether, 18 cases with three deaths were registered under this head, out of an average strength of 128,529, as compared with 1,392 cases and 348 deaths in the European Army of an average strength of 67,697. The recorded death-rate in the Native Army was 0·02 per 1,000 of strength, and 5·14 in the European Army. In the previous year the number of cases of enteric fever recorded in the Native Army was greater, and the deaths 18 as compared with only three in the year under report. It should not be forgotten that in cases diagnosed to be enteric fever it is rare in the case of Native soldiers to have the accuracy of the diagnosis verified in the fatal cases by a *post-mortem* examination. "It may be worth mentioning," to quote from the Report, "that year by year one medical officer's diagnosis contributes a considerable proportion of the cases registered in the Native Army." The Principal of the Lahore Medical College is of opinion that "the occurrence of the disease has some connection with the dietary of the patients." He is inclined to the belief that as a native of India assimilates his diet to that of Europeans he becomes more liable to the disease.

22. The total number of deaths from *plague* in the Native Army was 45. There were 65 cases with 39 deaths in the Deccan group. The Sanitary Commissioner remarks that, as usual, the chief point brought out in the extracts from the reports of regimental medical officers is the benefit derived from quitting the infected lines and living in the open.

23. To *tubercle of the lungs* were attributed 440 admissions and 87 deaths. The Gurkhas are more subject to this disease than other Native soldiers. The six highest numbers of cases were all in Gurkha regiments. The remarks made by the Medical Officer of the 1st battalion of the 4th Gurkhas are significant. "The most crowded barracks usually furnish the greater number of tuberculous patients . . . . the effects of overcrowding becoming more noticeable in a year spent by the regiment entirely in cantonments." The conclusion arrived at by the Sanitary Commissioner with the Government of India is that, whether the Gurkhas are, or are not, more prone to tubercle than other Native soldiers, "it is quite certain that overcrowding and defective ventilation favour the occurrence of the disease. The Gurkhas are stationed in climates that produce temptation to exclude the cold fresh air from dwellings."

24. To *respiratory diseases* nearly 40 per cent of all the deaths in the Native Army were due. *Pneumonia* of itself accounted for 2,097 admissions and 480 deaths. Both the admission and death rates from this disease were highest, as usual, in the Indus Valley and the Hills. The Medical Officer of the 1st battalion 4th Gurkhas writes:—"As the infectious nature of the disease under favourable conditions is beyond dispute, it is not surprising to find that the barracks with least cubic space furnished the greatest number of cases, and that the cramped space available in the hospital wards likewise favoured the spread of the disease to other patients undergoing treatment for other diseases at the time . . . . It is hoped that before long the hospital accommodation will be brought up to the authorised scale."

25. As in the case of ague, the dryness of the year seems to have had the effect of reducing the prevalence of *dysentery* and *diarrhœa*. The admissions due to dysentery fell from a ratio, per *mille* of strength, in the preceding year, of 44·0 to 38·0, and the deaths from a ratio of ·49 to ·35; whilst the ratios of admissions and deaths from diarrhœa fell from 9·4 of the former to 7·1, and from ·20 of the latter to ·12.

26. There was a marked decrease in the prevalence of *venereal diseases* in the Native Army in the year under report as compared with 1898; the admission ratio falling from 40, per 1,000 of strength in that year to 34·1 in the year under review. The movement of the ratio upwards or downwards is confined within somewhat narrow limits from year to year. The lowest rate recorded was in 1877, the first year for which the figures are available: in that year it was 26·7. The highest rate was recorded in 1890, when it rose to 41·1. The Gurkhas suffered proportionately more than other Native troops. It is remarked that their post-coitional habits are said to be less cleanly." The circumstance, also, that they belong to a different race and country may have something to do with their being oftener the subjects of venereal disease in India than other Native soldiers, who are generally stationed in their own country and among their own people; in the same way that the alien British and Dutch soldiers suffer more from venereal disease in India and in Java than they do when stationed in their own countries in Europe. In the year under report, while Gurkha regiments had an admission rate of 75·7 from venereal disease, other Native troops had an admission rate of only 33·9 per 1,000 of strength.

27. The *jail* population was of nearly the same average strength as in the previous year, decreasing slightly to 110,016. The health of the prisoners still further improved, the death-rate falling, again, from 25·87 in 1898 to 23·87 in the year under report. Except from cholera and tubercle of the lungs, there was reduced mortality from all the principal diseases, but especially from "anæmia and debility." The three diseases, dysentery, pneumonia and tubercle of the lungs, which caused half the mortality in the preceding year, were again credited with 52 per cent. of the total deaths during the year under report. To dysentery, ordinarily the most fatal of jail diseases, 23 per cent. of the total deaths were due; to tubercle of the lungs 15 per cent.; and to pneumonia 14 per cent. The returns show a wide difference between the jail mortality recorded in the several administrations. In Assam, with a death-rate of 55·18, the mortality ratio was highest, followed at a considerable distance by the Andamans with a rate of 42·24. In none of the other jail administrations did the rate reach 30 per 1,000 of the jail population, whilst in four of them it was below 20. Berar and Madras, the former with a ratio of 13·32, and the latter of 16·13, recorded the lowest death-rates. Of the two principal diseases, cholera and tubercle of the lungs, from which some increase of mortality occurred during the year, as compared with 1898, the former was entirely absent from the jails of the Punjab, Berar and the Andamans; it was only in the jails of Assam that cholera prevailed with great severity. In the latter province the mortality due to it reached a ratio of 13·61 per 1,000 of strength of the prison population; in one other province only, Burma, was it as high as one per 1,000. From remittent fever Madras alone records no death; whilst the province of Assam records, as in the case of cholera, the highest death ratio from this disease also. The jails of all the administrations suffered to varying degrees from dysentery; the Andamans recording a death-rate from this cause of 15·58, and Bengal and Assam 6·18 and 6·05 respectively. The jails of Berar and of the Punjab were remarkably free from this scourge of prison populations, the former returning a death-rate due to it of only 1·40 and the latter of 1·59 per 1,000 prisoners. The degree to which bowel complaints prevail in a jail may usually be taken as a fair indication of its general hygienic condition. The mortality from respiratory diseases was least in the jails of Madras and Burma, and highest in Assam and the Punjab; in the two former it was under two, and in the two latter it was about six per 1,000. Tubercle of the lungs caused the highest mortality in the Andamans and the lowest in Berar. As bearing upon the question of the comparative immunity of natives from enteric fever, it is to be noted that out of 40,792 cases of "fever" admitted into all Indian jails, only 21, with 12 deaths, were returned as enteric fever. Of small-pox deaths there were only five; and of cholera only 54. The Sanitary Commissioner truly remarks:—"When it is considered that the average daily strength of prisoners in India was 110,016 the fewness of the cases of cholera and small-pox is a remarkable tribute to the medical management of these institutions." During a year when plague was so widespread and fatal, there were only five attacks with two deaths recorded in the jails of India.

28. The rest of the subjects of the Report have already been separately dealt with in our *memoranda* on the several provincial sanitary reports, and need no further notice here. The Report before us is less bulky than its predecessor and is a model of conciseness, clearness and accuracy.

29. *Summary.*—The year was one of short and irregularly distributed rainfall. Whilst in places, especially on the eastern side of India, the fall was in excess, in Western India it was greatly in defect. To the dryness of the year was due, it is believed, the diminished prevalence of malarial diseases, which was a marked feature of its medical history. The European Army, of an average strength of 67,697, was healthier than in the preceding year; the ratios of admission into hospital, of constantly sick, of deaths, and of invaliding being all lower. The chief causes of admission were, again, venereal diseases and ague; whilst the chief causes of death were, also again, enteric fever and hepatic abscess. The chief causes of invaliding, as of admissions and total sickness, were venereal diseases and ague. Of the four Commands, Madras again records the lowest mortality rate, but the highest constantly sick and admission rates. The Punjab again records the highest mortality rate, although this has fallen to nearly half of what it was in the previous year. All of the Commands were healthier than in 1898. The larger stations, with garrisons of 1,000 or upwards, which returned the highest death-rates were Peshawar, Lucknow, Umballa and Bangalore. All of these, except the last, returned highest rates in the previous year. From three of the chief diseases, cholera, small pox and influenza, only a single death was caused by each. The occurrence of only one case of cholera in the European Army of India is without precedent in the records of any previous year. Ague and remittent fever were both less prevalent than in 1898, the consequence in part, no doubt of the exceptional dryness of the year. Enteric fever was much less fatal than in the previous year the number of deaths due to it falling from 654 to 348. This welcome decrease was probably due chiefly to the influx of drafts of young soldiers from England having been less in 1899 than in the preceding year. Several deaths from scarlet fever were recorded. Infection was traced with more or less of certainty in most, or all, of the outbreaks to the transport which conveyed the troops to India. Tubercle of the lungs and pneumonia caused almost the same number of deaths as in 1898;

e sickness and mortality from bowel-complaints showed a marked decrease. There was at e same time a decrease in the number of deaths from liver abscess. The continued decrease in the evalence of venereal diseases in the European Army is a gratifying feature of the year's returns. om a maximum of 522·3 per 1,000 in 1895, the admission rate has fallen to 313·4 in the year under port, a practical proof of the success of the sanitary measures recently enforced with the object of eventing the spread of these diseases amongst our young soldiers in India.. The Native Army ared in the improved health enjoyed by the European troops. The chief cause of admission into spital in the Native Army was ague, and the chief causes of mortality pneumonia and remittent ver. The Native Army, as usual, suffered comparatively little from those scourges of the European rmy, enteric fever and venereal disease. Cholera and small-pox were more prevalent than amongst e European troops. Respiratory diseases were the chief cause of mortality, pneumonia alone account-g for 480 deaths. The diminution in the prevalence of venereal diseases noted in the case of the uropean Army extended to the Native troops. The health of the jails of India, which had shown mprovement in the previous year, still further improved. Except from cholera and tubercle of the ngs, the mortality among the prisoners from all of the principal diseases was less.

14th May, 1901.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1899.

The rainfall recorded for the year exceeded that of the previous year by five inches, and was nearly ten inches more than the normal mean. It is stated that, although above the average in most places, it was not seasonable, The irregular distribution of the rainfall had an unfavourable effect on the agricultural cutturn; whilst its deficiency in September, and the absence of rain floods in October, "probably accounts," the Sanitary Commissioner thinks, "for the great unhealthiness of this province during the last quarter of the year." The principal food grains were cheaper than in the previous year, and also cheaper than the average. The high prices which had prevailed in 1897 gave place to low prices, and a return to prosperous times in 1898, followed by even lower prices in the year under report. As measured by the death-rate, the year was not so healthy as its predecessor. This result was unquestionably in great part due to the high birth-rate of the year under report, as compared with the birth-rate of the previous year. But, apart from the influence of this cause in raising the death-rate, an examination of the mortality returns of infants under one year of age for the two years shows that, whilst in the previous year the deaths amongst these were in the ratio of 192·35 per thousand, they were in the ratio of 246·13 in the year under report. There is, perhaps, no more sensitive gauge of the public health than the ratio of mortality amongst the infant population. The unusually large accession to the population of the province, which a birth-rate of 42·96, as compared with 35·79 in the previous year indicates, and the rise in the death-rate recorded for the infant population from 192·35 to 246·13, would together largely account for the higher death-rate of the year under report, as compared with that for 1898. The tendency which, under ordinary conditions, the death-rate has to rise and fall with the birth-rate is well illustrated by the figures for the two years 1898 and 1899. In the former the recorded birth-rate was 35·79 per thousand of population, and the death-rate 26·57; in the latter the birth-rate was 42·96 and the death-rate was 31·21. The proportion which the birth-rate bears to the death-rate of each of these two years is thus seen to be nearly the same. Besides the exceptionally high birth-rate of the year, another cause which must have contributed to raise the death-rate is that noted in the Government review of the Report. The natural increase of the population since last census was taken has been considerable. It is represented by the excess of births over deaths for the period 1892–99, and amounts on the average to 4·21 per thousand of population for each of those years, or the difference between the average birth-rate of 35·62, and the average death-rate of 31·34. We have thus for the year under report a birth-rate obtained by calculating the numbers of births resulting from a larger population on the figures of a smaller population. Obviously, the outcome of such a procedure would be to raise the recorded above the real birth-rate.

2. The Sanitary Commissioner is, no doubt, correct in attributing the high *birth-rate* of the year mainly "to the exceptional healthiness of the year 1898, and the greater prosperity of the people, resulting from two years of good harvests in succession, during 1897 and 1898, which enabled them thoroughly to recover their vitality after the preceding years of scarcity." The birth-rate is the highest hitherto recorded for the Province, but is exceeded by that of the Punjab, the North-Western Provinces and Oudh, and the Central Provinces. That the real birth-rate is still higher than that recorded is shown by the investigations made by the Inspectors and Sub-Inspectors of vaccination. These officers found that of the births and deaths regarding which they made inquiry in the towns and villages, 1·13 of the former, and 1·14 of the latter, had not been reported at the Police Stations by the *Chaukidars* or Watchmen. That the discrepancies between the reported numbers of births and deaths, and those ascertained by special inquiry, should be so inconsiderable, is proof of the remarkable improvement accomplished in the registration of vital statistics in the Province of Bengal within the last few years. Taking the figures as they stand to represent with approximate accuracy the number of births and the number of deaths, the natural increase of the population in the single year under report has been no less than 834,935. In other words, the births exceeded the deaths by this number.

3. Accompanying, and without doubt, partly at least, owing to the high birth-rate, there was a high death-rate. This latter rose from 26·57 per thousand of population in the preceding year to 31·21 in the year under review, and was higher than the rate recorded for the past ten years by 1·93. This increased mortality, the Sanitary Commissioner writes, "was chiefly due to the unhealthiness

of the year, as testified to by the Civil Surgeons of 33 out of 45 districts, the mortality fr[illegible] and cholera having risen from 19·97 and ·91 in 1898 to 22·61 and 1·51 respectively." The addition the population of a much greater number than in the previous year of the class yielding the high death-rate, that is to say, of infants, could not fail to contribute to a higher death-rate in the y under report. At the same time the increase in the mortality amongst infants from 192·35 in t previous year, to 246·13 per thousand in the year under report, shows that when the health of the t years is measured by the comparative mortality recorded for the same section of the populati 1889 was less healthy than its predecessor. As with the birth-rate so with the death-rate, and for t same reason the growth of population since last census must have tended to raise the recorded abo the real death-rate. In the table included in paragraph 18 of the Report, giving a list of are recording excessive mortality due to cholera and fever, it is interesting to note the birth-rates in t areas recording the highest death-rates. It will be seen that, as the Sanitary Commissioner remarks, t first five places in the list are occupied by five of the rural areas in the Murshadabad district. Takin this district as a whole, it records a death-rate of 43·00 per thousand of population against the pr vincial rate of 31·21. At the same time, it records a birth-rate of 48·68 against the provincial rate 42·96. Of the five rural areas of the district with the highest death-rates, two record birth-rates upwards of 48, and two of upwards of 52 per thousand of population. The high birth-rates and th high death-rates would thus appear to be intimately related to each other. The greater the proportiona number of those least capable of resisting the tendency to death, that is to say, of infants, in th population, the higher ordinarily will be the death-rate in that population. "As usual," writes the Sanitary Commissioner, "the mortality from cholera, dysentery, and diarrhœa, and other causes, was much higher in towns than in rural areas, while fever was more prevalent in rural areas." The cause of this difference was attributed in the previous year's report to "overcrowding in towns with its attendant evils, and to absence of proper drainage and good drinking water in rural areas." In our Memorandum on the Report for 1898, we suggested as an alternative explanation the more intelligent differentiation of the causes of death in towns as compared with rural areas. If the table given in paragraph 19 of the Report be examined, it will be found that whilst towns record a ratio of 17·08 deaths from fever, rural areas record one of 22·89. On the other hand, whilst towns record a ratio of 10·11 deaths, under the heading of "other causes," rural areas record a ratio of only 5·59 under that heading. These figures would certainly seem to indicate higher fever mortality in rural areas than in towns; but if the deaths recorded as due to fever are added to those recorded as due to "other causes," in the case of towns and rural areas, the totals will be found closely to approximate. In towns the death-rate from fever and "other causes" combined was 27·19; and in rural areas 28·48. The inference may be suggested that whilst "fever" is made to include indiscriminately a variety of diseases amongst the more ignorant rural population, these diseases have been somewhat more successfully differentiated in towns, the inhabitants of which may be assumed to be more intelligent. The statistics of mortality recorded by qualified medical practitioners in the North-Western Provinces clearly show that a considerable proportion of the deaths caused by diarrhœa and dysentery are ordinarily credited to fever. The recorded ratio of only ·45 deaths per thousand of population in the rural areas of Bengal certainly falls far short of the actual ratio. The higher ratio of 3·07 deaths attributed to these diseases in towns may be due, as already suggested, to a somewhat more intelligent differentiation of diseases rather than to the comparatively greater prevalence of bowel complaints in towns than in the country. It is hardly credible that the inhabitants of towns are six or seven times more liable to die from these diseases than the inhabitants of country villages. With a view to ascertaining, with some near approach to accuracy, the proportion of deaths caused by each of the chief diseases, the experiment carried out in the North-Western Provinces might, perhaps, be usefully carried out in Bengal. In the North-Western Provinces returns of all the deaths, the causes of which have been verified by qualified medical men, are yearly submitted to the Sanitary Commissioner, and the results tabulated by him in his Annual Report. A comparison made between these and the results obtained from the returns made up from the reports of the *Chaukidars*, who are the chief agents employed in collecting the provincial statistics, helps to guard against fallacious conclusions being drawn from the latter, and to show in respect of what diseases they are most likely to be deceptive.

4. *History of Chief Diseases.—Cholera*, from which India had enjoyed remarkable immunity during the previous year, caused 107,678 deaths, as compared with 65,020 in 1898. Although not exceptionally destructive of life during the year under report, it was widespread, no district of the 46 having being entirely exempt from it. The Malda district suffered excessively, recording a cholera death-rate of no less than 6·28 per thousand of its population against only ·12 in the previous year. As usual, some endeavour is made to explain the outbreak and progress of the disease. The Civil Surgeon of Malda writes:—"After the terrible cyclone that blew over over Bhagalpore in October, several dead bodies and carcasses came floating down the Ganges, and were left in the *churs* all along the western border of the district. The epidemic dates from that very month. There was raging just then a terrible epidemic on the other side of the Ganges too." The latter statement would suggest the explanation that the outbreak was simply an extension of the disease across the river, which does not prevent constant intercourse between the inhabitants of its two banks. The Civil Surgeon of Puri gives a graphic account of the circumstances attending the prevalence of cholera in his district, which, next to Malda, suffered more than any other in the province. Those circumstances are now everywhere acknowledged to be actively concerned, if not in originating the disease, at all events in intensifying and spreading it. He says:—"We have, therefore, all the elements necessary to manufacture a cholera epidemic, viz., poor physique to start with (Hindu widows), privation of all sorts, starvation, indigestible food, polluted water, exposure to rain, wind and sun, overcrowding on the journey, with no doubt insufficient opportunities for obeying the calls of nature (and when they do relieve themselves it is generally at the edge of their drinking-water supply!)." To those not conversant with pilgrimages in India, the prevention of the conditions conducing to the "manufacture" of a cholera epidemic, thus graphically described by Dr. Hendley, may seem comparatively easy. In reality it is very much otherwise. In some of the other districts in which the disease prevailed in severe epidemic form, "the early cessation of the rains and the consequent earlier pollution

water supply" are assigned as the chief factors concerned in the development of the epidemics. Anti-cholera inoculation would not appear to be making much progress. On this subject the Sanitary Commissioner writes :—"From isolated returns like these no inference can be drawn regarding the prophylactic quality of inoculation, as well as the period for which immunity is conferred by a single inoculation." He adds that the information now received relating to the protection afforded to the inoculated coolies while *en route* to the labour districts is meagre. Such information with regard to the coolies annually despatched to Assam has long been awaited.

5. *Small-pox* was somewhat less fatal than in the previous year. The death-rate due to it was ·18 per *mille* of population as compared with ·20 in 1898, and with ·20 the average of the past 10 years. Over two-thirds of the total deaths from it were returned by Orissa alone. In Cuttack, a district of the Orissa division, in which the disease was very prevalent, the cause of the heavy mortality is attributed by the Civil Surgeon to insufficient vaccination, and to the practice of inoculation. Vaccination recovered some part of the ground lost during the previous year; but the total number vaccinated still fell short of the figures recorded for 1897–98. In the latter year 2,319,536 operations were performed, as against 2,225,252 in the year under report; and yet during the latter the number of operators employed was greater by 114 than in the previous year. Under these circumstances the amount of work done might have been expected to be greater; but after reading the account given by the Sanitary Commissioner of the way in which his deputies were mainly employed during the year, the wonder is that the results of the season's operations were so satisfactory as they are recorded to have been. Major Dyson describes the duties which occupied his three Deputies during 1899 in the following words :—"Captain Clemesha was almost entirely engaged in plague work, and Captain Rogers in inspecting the sanitary condition of the riparian municipalities north of Calcutta, while Captain Hayward's time was occupied in superintending plague measures in and around Patna. These officers were consequently unable to inspect vaccination work." It may be a question whether, in the absence of the supervision of the Deputy Sanitary Commissioners, the returns of vaccination can be accepted with the same confidence as usual. It is common experience that nowhere in India can the strictest supervision of vaccination be relaxed without risk of falsification of returns following. It is unfortunate that, owing to the exigencies of the public service, officers appointed to supervise vaccination as part of their duties had to be withdrawn for employments which left them no time to make personal inquiry into the work of vaccination. Like his Deputies, the Sanitary Commissioner himself found his time so fully taken up with plague duties that he must have been practically unable to give any part of it to the inspection of vaccination. In the Government review of the Sanitary Commissioner's Report it is stated :—"Major Dyson was on tour for 160 days during the year. Practically, the whole of this time was taken up with the organisation and inspection of Plague Camps." In the Western Circle, Assistant Surgeon Gopal Chandra Mukerji inspected 12,592 operations, and the Civil Surgeons are stated to have shown greater activity in the work of inspection than in the previous year. The percentage of successful cases recorded in primary vaccination was 97·67, or almost the same as in the previous year. In re-vaccinations the number of operations decreased from 60,167 to 48,537, and the percentage of success from 67·34 to 49·59. This decrease in the percentage of success is not, perhaps, to be regretted; it may imply a more rigorous exclusion of unsuccessful or doubtful cases from the list of those hitherto entered as "successful." A satisfactory feature of the season's work is the more general use of vaccine-lymph direct from the calf. The total number of primary vaccinations performed direct from the calf during the year shows an increase of 35,000 operations as compared with the previous year. It is satisfactory, also, to find that there has been a substantial increase in the number of children under one year of age who were submitted to be operated upon. This number rose from 502,300 in the previous year to 619,068 in the year under report.

6. The recorded mortality from *fever* was greater than in the previous year. But here again the figures are apt to be deceptive. In the first place, registration of vital statistics has vastly improved since 1892, and fewer deaths from fever, as from other diseases, remain unrecorded. And in the second place, the population of the Province has much increased since last census was taken, whilst the census figures are still used in calculating percentage of births and deaths. Still, when every allowance is made for these causes, as well as for the record under the head of fever of many deaths due to other causes, it remains true that, in the words of the Sanitary Commissioner, this disease "exercises a terrible influence on the health and prosperity of the people." During the year under report, nearly 73 per cent. of the total deaths from all causes were recorded under the head of fever. In the Government Review of the Sanitary Report, reference is made to a special report by Captain Rogers on the fever prevailing in the riparian municipalities on the eastern bank of the Hooghly. The report is described as a "a particularly well reasoned and valuable document." Some of the inquiries made by Dr. Rogers are briefly described. "The remarkable feature of the report is the very great effect which the provision of a filtered water-supply is shown to have in reducing the fever rate in areas which contain every other known factor, including the anopheles mosquito, productive of a high rate of malaria." The cause, or causes, of fever and of its cyclical recurrence over wide areas in an intensified and destructive form have never hitherto received an explanation which can be regarded as complete. Perhaps it may be found possible to include Captain Rogers' report, or a review of it, in the Sanitary Commissioner's Report for 1900.

7. The mortality from *dysentery* and *diarrhœa* increased over that recorded in the previous year in approximately the same proportion as did the mortality from fever. The number of deaths from these two diseases rose from 37,155 in 1898 to 41,334 in the year under report, at the same time that the deaths from fever rose from 1,419,483 in the former year to 1,607,279 in the latter. The Sanitary Commissioner thinks the increased prevalence of bowel complaints "was to some extent due to the causes which led to increased cholera in many districts, viz., early cessation of the rains and the early pollution of the water-supply." It would perhaps be safer to say that increased cholera in many districts coincided with early cessation of the rains and the early pollution of the water-supply; at all events, until these conditions and the increase of cholera can be definitely proved to have stood

towards each other in the position of cause and effect. Reasons have already been given for accepting without reservation the accuracy of the returns which show bowel complaints to have been from six to seven times more fatal in towns than in rural areas.

8. Regarding *plague*, there is little told that can be said to be new. The observation camps at Chausa, Chakradharpur and Mairwa, situated on the western border of the Province, "were in full working order throughout 1899." The Sanitary Commissioner says they successfully intercepted "almost all" the suspected cases of plague trying to pass into or out of the Province. In the Government review of the Report, the work done at these camps is thus summed up :—"At the camps which were in existence at the close of the year, a total of no less than 1,797,350 persons were examined, of whom 15,651 were detained as presenting suspicious symptoms. Twenty-nine deaths occurred among the detenus, of which eight were due to plague.

9. *Sanitary Works.*—Expenditure appears to have been devoted to the maintenance and improvement of existing sanitary works rather than to the initiation of new ones. This year, again, the precautionary measures adopted with the object of preventing the spread of plague absorbed large sums which might otherwise have been spent on sanitary works of a permanent character. The most important sanitary improvement effected during the year was the completion of the new water-works at Berhampore. The Sanitary Board met three times during the year. Preliminary estimates were prepared under the orders of the Board for improvement of the Darjeeling water-supply and for the Patna waterworks, and various estimates and plans of sanitary works were submitted to the Board for an expression of opinion. It appears that the position and functions of the Sanitary Board in Bengal are different from those fufilled by other Sanitary Boards in India, inasmuch as it has been, and still remains, in practice mainly a consultative body. The Board agree that Mr. Buckley's note in their proceedings of the 10th June, 1899, in which he wrote, "What I fear and what I feel is that in Bengal the Sanitary Board is of little practical good, and that somehow or other it is not in the least what the Secretary of State, the Government of India, and the Government of Bengal intended that it should be," is correct. If after 10 years' experience the Board still finds itself of "little practical good," it might perhaps be time to confer upon it the "definite executive authority" which it seems to deem needful to render it more useful.

10. *Summary.*—The year, although, as measured by its death-rate, less healthy than its predecessor, cannot be described as having been unhealthy, at all events until near its end. The normal rainfall was exceeded ; and food grains were cheaper than ordinary. Following an exceptionally healthy and prosperous year, 1899 returned the highest birth-rate hitherto recorded for the Bengal Province. Accompanying, and in part at least owing to this high birth-rate, there was a high death-rate. Improvement of registration of vital statistics, and increase of population since last census was taken, helped to raise the recorded above the actual birth and death rates. Cholera was more fatal than in 1898, but although widespread, the mortality due to it was not excessive except in a few districts. The death-rate from small-pox was only 0·18 per thousand of population. Vaccination recovered much of the ground which it had lost in the previous year, but the numbers vaccinated were still below those for 1897–98. Unfortunately, owing to other duties mainly connected with plague, neither the Sanitary Commissioner nor his Deputies were able to devote personal attention to the inspection of vaccination. Fever was credited with having caused no less than 73 per cent. of the total mortality of the year. Fatal as fever itself always is, a large proportion of the deaths attributed to it are unquestionably due to other diseases. Bowel complaints were more fatal than in 1898, and it is certain that they were more fatal than the returns would show them to have been. The Sanitary Board held three meetings during the year. The positions and functions of the Board in Bengal are different from those of Sanitary Boards in other Provinces of India. Its members are of opinion that the Board will continue to be wanting in practical usefulness until it has been endowed with some measure of executive authority. Expenditure on sanitary works during the year was devoted to the maintenance and improvement of existing works rather than to the initiation of new ones.

14th May, 1901.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-Western Provinces and Oudh for 1899.

The preparation of the report fell to the Officiating Sanitary Commissioner, Major Giles, I.M.S., who was in charge of the Department during no part of the year. The weather was characterised by several important departures from normal. There was a general failure of the winter rains. During the first three months of the year practically no rain fell, except in a few stations in or near the hills, and the last two months were absolutely rainless. On the other hand, the ordinarily dry months of April and May recorded more than the usual amount of rain. The monsoon set in, as usual, about the middle of June, and continued to be, on the whole, satisfactory up to the middle of August ; but from this time the rains may be said to have entirely ceased, September having been in most districts rainless, with the exception of a couple of days about the middle of the month. The temperature of the year did not vary greatly from normal. As might have been expected, the unusual rainfall in April and May tended to lower the temperature of those two months, whilst as a consequence of the premature cessation of the monsoon, temperatures during the closing months of the year were higher than usual. There was only a fractional difference in the mean price of food grains during the two consecutive years 1898 and 1899.

most remarkable feature of the year was its *birth-rate* of 48·09 per 1,000 of population, the ...est hitherto recorded. The rate for the previous year was 37·35, and the mean for the previous ... years 35·69. The high birth-rates which characterised each month of the year under review ...ere a continuation of those which began to be recorded during the latter half of the preceding year, ...d were due, doubtless, to the same cause, the cessation of a prolonged period of high prices of food ...erywhere and of scarcity or famine over wide areas, succeeded by a return of prosperity and the ...pid recovery of the population from the effects of hardship and distress. The number of births ...ceeded the number of deaths by 761,731. An addition in a single year of upwards of three-...arters of a million, or 15·97 per 1,000, to the population of a province already densely inhabited ...er a large part of its area, is doubtless a remarkable proof of recuperative power from the effects of ...vere and prolonged distress; but it is apt to suggest certain anxieties for the future, in the case of ...people chiefly dependent for subsistence on the cultivation of a soil liable to periodical and ...tensive failure of its crops. During the past 19 years the population of these provinces has ...creased by more than four and a quarter millions. During the same period, the common food ...ains have risen in price from a mean of 21·53 *seers* per rupee in the first 10 of those years, to 16·90 ...n the last of them. Unless wages have increased proportionately with the increase in the price of ...he staple food grains of the people, the struggle for existence must have been growing more acute. The growth of population during these 19 years may stand in no casual relation to the rise in the price of food; the rise may have been due to other causes, but increase of the population numbers and of the food prices mentioned appear from the returns to have been going on together. Although, during the year under review, all of the districts return unusually high birth-rates, the Sanitary Commissioner shows that the increase was most marked in the districts famine-stricken in 1897. This, he says, "would appear to justify Doubleday's well-known generalisation, that one of the consequences of famine is to increase fertility."

3. Accompanying the increase in the birth-rate, the *death-rate* rose from 27·38 per 1,000 of population in the previous year to 33·19 in the year under review. This large increase was, in part at least, due to the still larger increase in the birth-rate of the year. Not only was a far greater addition made to the population of that section of it most liable to death, that is to say, of infants, but the rate of mortality was higher amongst those under one year of age than it was among those of the same class and age in the preceding year. Whilst in 1898 the number of children born was 1,751,725, and whilst those died at the rate of 224·0 per 1,000 living, in the year under report the number of children born was 2,255,627 and these died at the rate of 323·1 per 1,000 living. Put otherwise, children under one year of age contributed 359,621 to the total number of deaths in the previous year, children under one year of age contributed 530,355 to the total number of deaths in the year under review. In paragraph 10 of his Report the Sanitary Commissioner gives the names of the six districts which returned the highest death-rates during the year. Excluding from these Naini Tal, the circumstances of which are exceptional, owing to the constitution and annual movement of its population, the remaining five districts return death-rates of from 39·07, the lowest, to 41·93, the highest. Turning to the tables recording the birth-rates, it will be seen that every one of the five districts returns a rate above the provincial average, Lucknow recording the lowest of 48·37 and Etah the highest of 61·14 per 1,000 of population. If the high death-rates of these districts were due solely to their exceptional unhealthiness, one would expect as a result of the enfeeblement of the people from such unhealthiness to find low birth-rates recorded. But the birth-rates are, on the contrary, high; and from this it seems fair to infer that a high death-rate does not necessarily imply unhealthiness of a population, but may sometimes be due, in part at least, to a birth-rate so high as to be of itself an indication not of unhealthiness but of its opposite. In paragraph 19 of the Report it is stated that "the infantile death-rate in 1899 was 264·7." It is not clear how these figures were arrived at. In a preceding table the population numbers of children under one year of age, according to last census, is given as 1,640,597, and the deaths among them as 530,355. Those figures yield a ratio, not of 264·7 but of 323·2; and these latter figures are in agreement with those given in Annual Form No. IV. page 8B of the Appendix. It would, perhaps, be preferable to calculate the infantile death-rate by using, not the census number of children under one year of age, but the number of children born during the year for which the calculation is made. If the latter method of making the calculation is adopted, the infantile death-rate for the year will work out to be 230·51 per 1,000 of children born, instead of 323·2.

4. This year again, the Report contains a very useful return embodying the results of the verification of deaths by medical officers, medical subordinates, and medical practitioners generally. These results provide a sort of standard by which to gauge the general returns of death causes recorded by the unprofessional agents employed to collect and record the vital statistics of the province. The total number of deaths, the causes of which were verified by qualified medical agents during the year, was 9,684. Of this number 4,484 were of children under 15 years of age, 3,011 of adults from 16 to 45 years of age, and 2,189 were 46 years of age and upwards. The number of deaths attributed to fevers of all kinds holds the foremost place, as in the provincial returns; but instead of accounting for approximately four-fifths of the total number of deaths from all causes during the year, as in the provincial returns, they form less than one-third of the total. Of the 3,059 deaths diagnosed as due to fevers of all kinds, the specific form of fever is not stated in 1,943 of the cases. Of the fevers specified, seven fatal cases are classed as enteric. In connection with the question of the supposed prevalence of enteric fever amongst native children, sometimes adduced to account for the remarkable immunity which adult natives appear to enjoy from this disease, it may be noted that there was no death recorded as due to enteric fever among children of less than eight years of age. Of the seven fatal cases of enteric fever diagnosed, four occurred amongst persons between the ages of eight and 15 years, and three amongst those between 15 and 45 years. As causes of death, dysentery and diarrhœa would appear to play a far more prominent part than they have assigned to them in the provincial returns. No fewer than 1,439, or more than one in seven of the total 9,684 deaths from verified causes, were due to these diseases. In the provincial returns only 27,206 out of a total of 1,556,821, or about one in 57, are attributed to these diseases.

5. *History of Chief Diseases.*—The number of deaths attributed to *cholera* was 8,142, the [illegible] recorded from this disease for any of the last 29 years, with the single exception of 1898. There have thus been two consecutive years of exceptionally low cholera mortality. But for the fact that its incidence was unusually light, the history of the disease appears to present no special feature during the year. As in most years, the mortality was highest in August: and, as also in most years, the first three months were those of least cholera prevalence. In the Report by Captain Fullerton, Deputy Sanitary Commissioner of the First Circle, an interesting account is given of the outbreak of cholera in the Dehra Dun district, and of the remarkable effect the closing of the canal which ran through the station had in cutting it short. "The closing of the canal was followed by the complete subsidence of the disease in less than a week." In a sample of water taken from this canal and sent to Mr. Hankin for examination "the microbe of cholera was discovered in a virulent form." Captain Fullerton has much confidence in the efficacy of the permanganate of potassium disinfection of wells during cholera outbreaks, and gives it as his opinion that if the disinfection "is properly carried out the disease will disappear in from three to seven days."

6. Like cholera, *small-pox* has been in remarkable abeyance during the two years 1898 and 1899. In the former of these years the death-rate from this disease was only 0·05 per 1,000 of population, and in the latter 0·04. Excepting in 1895, when it was the same, the rate for the year under report is the lowest on record in these Provinces. The work of the Vaccination Department has been satisfactory. The total number of primary vaccinations increased from 1,227,261 in the previous year, to 1,365,931 in the year under report. Part of this increase is accounted for by the increased strength of the vaccination staff as compared with its strength in 1898-99. But apart from this, the returns show that, on the average, each vaccinator performed 1,683·11 operations, as compared with 1,598·50 in the previous year. Yet, although the total numbers vaccinated compare favourably with the numbers for 1898-99, they show no great increase over the number of primary vaccinations in 1895-96 and in 1896-97. But in the year under report there was a very marked improvement in the percentage of successful primary operations in which the result was ascertained. This percentage increased from 94·96 in the previous year to 97·00 in the year under report. Humanised lymph is still mostly used in these Provinces; but one large bovine depôt is established at Lucknow, and minor depôts at Allahabad and Bahraich. The crude lymph as supplied from these depôts is said not to retain its efficacy for any length of time. Perhaps it might be expedient to select and send an officer of the Department to Shillong to study the process of animal lymph preservation practised there by Colonel Campbell, the Civil Surgeon. This process is stated to have proved completely successful. Perhaps the most satisfactory feature of the season's work is the large increase in the amount of infant vaccination. The number of infants successfully vaccinated increased from 633,534 in the previous year to 848,675 in the year under review. The Second Circle, which includes the Province of Oudh, has hitherto shown a disappointingly small return of infants vaccinated; but in the year under report the number has increased to 317,575 from 199,199 in the preceding year. Than this there could be no better proof that the prejudice against vaccination, still strong in many parts of the Province of Oudh, is being gradually overcome.

7. The number of deaths registered under the head of *fever* increased from 1,063,596 in the preceding year to 1,245,260; but, as the Sanitary Commissioner remarks, "the heading of fever has so loose an application in our available statistics that it can hardly be said to have more than a rough proportionate relation to the general amount of malarial disease." The researches of Laveran, Ross, and others, whilst they shed a flood of light on much that hitherto has been obscure regarding so-called malarial fevers, show that experience in the past had discovered in drainage one of the most effectual means of diminishing or extinguishing those fevers in localities in which they were endemic. Drainage will, apparently, lose none of its importance in consequence of the discovery that certain species of mosquitoes are active agents in the dissemination of malarious fever; since by depriving the mosquitoes of the medium in which they breed, it will tend to bring about their diminution or extinction. Nor, when prevention has failed and the disease has been contracted, is it probable that quinine will cease to retain its position as one of the most efficient remedies in the treatment of malarial fever. Indeed, judging from the system of treatment recommended by Ross, the probability is that, instead of losing, it will in the future gain in importance as a remedy.

8. Only 27,206 deaths from *dysentery* and *diarrhœa* were registered during 1899. Reasons have already been given for the belief that the mortality from these diseases is higher than the returns would lead one to conclude. The urban death-rate ascribed to them was 2·08 per 1,000 of population, as compared with 0·47 in rural areas. It is difficult to believe that the inhabitants of towns are nearly five times more liable to die from these diseases than the inhabitants of country villages.

9. It would have been satisfactory to have had some explanation of the sudden increase in the number of deaths registered under the head of "all other causes." From 167,481 in the previous year these have risen to 250,644 in the year under report. An examination of the returns of deaths at pp. 12B.-17B. of the Appendix rather tends to weaken confidence in even some general approach to a correct record of deaths according to their causes having been reached. For example, in the Etah district, out of a total death-rate of 41·88 from all causes, 10·21 are credited to "all other causes"; the next district on the list, Muttra, records a death-rate of 37·67 from all causes, and 0·50 from "all other causes." Similar contrasts will be found in the returns for towns. Farukhabad and Agra record almost the same death-rates from all causes, that of the former town being 41·05, and of the latter 41·14; yet the death-rate from "all other causes" in Farukhabad was 1·85, and in Agra 20·78.

10. Until nearly the end of the year no indigenous case of *plague* was reported in these Provinces. There were a few imported cases of the disease, but these gave rise to no others. Towards the end of November, however, a family of three persons of the weaver class, returning from Bombay to their homes in a village of the Allahabad district, appear to have brought plague with them and to have communicated it to other inhabitants of the village. Cases continued to occur until the end of the

der review, but the measures taken to prevent its spread beyond the village seem to have been successful. The account of this localised outbreak belongs to next year's report. The Sanitary Commissioner gives a list of officers, 80 in number, employed at one time or another on plague duty during 1899. He writes :—"Inspections at border stations have been steadily maintained throughout the year. As a matter of fact no case of plague has, however, been detected at any border station, while, on the other hand, the less elaborate inspections at minor stations have from time to time detected several cases of real or suspicious plague (two in the year under review)." The total number of cases brought to light is, however, very small in proportion to the large agency employed."

11. *Sanitary Works.*—Of the 104 municipalities in these Provinces only nine have as yet been provided with waterworks; but these nine towns together contain approximately 1,038,433 inhabitants, or nearly one-third of the total population of all the 104 municipalities. Much attention was given during the year to measures designed to maintain the water supplied by these works of a high standard of purity. Further precautions were deemed needful to protect the Jumna from contamination near and above the intake of the Agra water supply. The filtering area of the Agra waterworks being considered to be insufficient, it was decided to increase it by the addition of another filter bed. Excepting of that delivered by the waterworks at Agra, the quality of the water supplied to the other towns provided with waterworks is said to have been "quite satisfactory." The important sewerage works at Benares are being proceeded with. The Sanitary Board met four times during the year, and had under consideration questions connected with the drainage works in course of construction at Benares; with the question of a water supply for Jhansi, and other matters of a kindred nature. The maintenance of sanitation books in villages, in accordance with the provisions of the Village Sanitation Act, was the subject of inquiry by the Sanitary Commissioner, and it was ascertained that in 22 districts the orders of June 1899 had been carried into effect by the end of the year, while in others steps were being taken to introduce the prescribed records. In two districts, only, no beginning had been made towards carrying into effect the orders regarding these village sanitation books.

12. *Summary.*—The year was not unhealthy, although its death-rate was considerably higher than that recorded in the previous year. Its rainfall was in some respects abnormal. The winter rains were deficient; there was an unusually heavy fall in April and May, and the monsoon set in at the usual time but ceased prematurely. Prices of the staple food grains differed but little from those which ruled in 1898. The most remarkable feature of the year was its birth-rate: this was the highest hitherto recorded. Both cholera and small-pox were less prevalent than usual. Vaccination made good progress, the large increase in the number of infants vaccinated being a specially favourable feature of the season's work. Fevers and bowel-complaints caused a somewhat higher mortality than in the previous exceptionally healthy year. The marked increase in the number of deaths recorded under the heading of "all other causes" seems to need explanation. Until towards the end of the year the Province recorded no indigenous case of plague; but the return in the end of November of three persons from Bombay to their home in a village some twenty miles from Allahabad, was followed by the outbreak of plague among the villagers. The active measures taken to circumscribe the disease were successful. Of important sanitary works the construction of the great drainage system at Benares, still in progress, was one of the chief. Much attention was paid to the maintenance in an efficient state of the waterworks in the nine municipal towns possessing them. The quality of the water supplied by these works, with one exception, is stated to have been quite satisfactory.

13th May, 1901.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1899.

The Report has the merit of brevity. It covers only 28 pages, and of these several are taken up with tabular statements. In our Memorandum on the previous year's Report, it was suggested that in future a short paragraph might be devoted to an account of the main meteorological features of the year, and some estimate made of the effect which the weather, the prices of food grains, and the rate of wages earned by the labouring classes, appeared to have exercised on the general health of the population of the Province. We would venture to repeat this suggestion. From the statement given in Appendix F, it is gathered that the average rainfall of the year under report was for every quarter much below the average for the corresponding quarters of the previous ten years. The decrease was most marked in the third quarter, when an average of only 7·77 inches fell, as compared with 17·53 recorded for the third quarters of the previous ten years. The total rainfall for the year under report was only 13·63 inches, as compared with 24·14 in the previous year, and with an average for the ten previous years of 27·84. A decrease of the rainfall to less than half the average would necessarily have important effects on the supplies of food and water for man and beast. The average prices of food grains were generally higher than in 1898. An examination of the table given in Appendix F shows that, whilst the tendency of grain prices was to fall during 1898 from the high rates with which the year began, the tendency in the year under report was in the opposite direction, prices having been lower in the early part of the year, and higher towards its end. This was only what was to be looked for as a result of the deficiency in the fall of rain during the third quarter of the year.

2. The *birth-rate* of 48·4 per thousand of population is the highest hitherto recorded in the Punjab. No doubt the population of the Province has largely increased since the last census was taken. This increased population would yield a greater number of births and, unless calculated on

the increased population numbers instead of on those of the last census, the recorded bi[illegible] would exceed the actual rate. If the increase of the population which has taken place during the last five years be calculated by adding together the numbers by which the births have exceeded the deaths during those years, it will be found that between 1895 and 1899 the population has increased by no less than 1,362,622. And this probably does not represent the whole of the increase. As the Lieutenant-Governor remarked in the review of the Sanitary Commissioner's Report for 1898, great changes in the population are going on in these days in consequence of the construction of railways and canals. But although the high birth-rate can be shown to be in part due to the increase in the population since the last census was taken, it was also no doubt partly due to the better times which set in towards the end of 1897 and continued throughout 1898. A marked rise in the birth-rate seems to be a normal characteristic of a period of prosperity following upon hard times. The effect which increase of the population since last census may have in raising the birth-rate is well exemplified in the case of the Jhang District, which records a rate of 69·1. This extraordinarily high rate is said to be due "to the large influx of people in the district in consequence of the opening of the Chenab colony." Improvement in the registration of vital statistics and the consequent omission of fewer births from the registers may also have had a share in raising the recorded birth-rate. The registered number of births exceeded the registered number of deaths during the year by no fewer than 386,276 or by 18·8 per thousand of population. This may, no doubt, be accepted as an indication that the times are prosperous; but it cannot fail likewise to suggest certain anxieties for the future in a country subject to periodic failure of rain and crops, and with a population largely made up of labouring classes living from hand to mouth.

3. The *death-rate* fell from 31·05 in the preceding year to 29·57 in the year under report. For the same reason that the recorded birth-rate has been shown to be higher than the actual birth-rate, the recorded death-rate can be shown to be higher than the actual death-rate. If the death-rate were calculated on the larger population numbers of the year yielding the deaths, instead of on the smaller population numbers of the last census, it is evident that it would be lower in the former than in the latter case. As a high death-rate ordinarily accompanies a high birth-rate, and as the latter was the highest ever recorded in the Punjab, a death-rate of 29·57 may be regarded as indicating that the year was a healthy one. A reference to the table given in paragraph 21 of the Report will show that, of the total number of deaths during the year, rather more than a third were those of infants under one year of age. Whilst the death-rate for the entire population was only 29·57 per thousand, it was 230 for children under one year of age taken separately. From this it is obvious that the greater the proportion which the number of children under one year bears to the entire population, or, in other words, the higher the birth-rate the higher will be the death-rate. The very high birth-rate of 69·1 per thousand of population in the Jhang District, the highest recorded in the Province, has already been referred to. Accompanying this, in the same district, there is a death-rate of 41·6, also the highest recorded in the Province. Regarding the Jhang District, the Sanitary Commissioner remarks, "The high death-rate is due chiefly (1) to malarial fever brought about by irrigation; (2) to under estimation of the male population." Doubtless these causes contributed to the record of a high death-rate; but unless the birth-rate had been exceptionally high it is probable that the death-rate would not have been exceptionally high. From Annual Form No. IV. appended to the Report it will be seen that, of the 18,152 deaths which were recorded in Jhang no fewer than 6,204 were deaths of children under one year of age. The high birth-rate and the high death-rate of this district would thus appear to be intimately related to each other.

4. *Registration of Vital Statistics* continues to receive much attention. The results of the testing of the entries in the registers by the several agencies show, however, that a considerable percentage of the births and deaths still remains unrecorded. Excepting in the frontier districts, where special difficulties have to be contended against and where persistent efforts are being made to overcome them, the results show that the registration of vital statistics in the Punjab is effected with a close approximation to accuracy.

5. *Chief Diseases.*—Although *cholera* appeared in epidemic form in some districts, the mortality due to it was inconsiderable. Only 1,816 deaths were attributed to the disease, giving a death-rate of 0·09 per thousand of population. The Punjab is outside the endemic area of cholera, and is subjected to destructive invasions of the disease only at long intervals. During the past 33 years cholera deaths have only in three of them caused a mortality of 1 per thousand of the population. In the year under report some evidence is given to support the opinion that the disease was imported into the localities affected by it; but it is mostly of an inexact and inconclusive character. The outbreak in Shahpur, the district which suffered most, followed the arrival from Hissar by train of "a large body of famine sufferers." The conclusion arrived at by the Sanitary Commissioner regarding the conveyance of the disease from Hissar to Shahpur by these sufferers is stated in these words:—"Everything points to the disease being brought with them from Hissar, though cholera was not reported in that district till some days later." On the other hand, the Civil Surgeon is of opinion that cholera was not imported into that district but "originated *de novo*," as a consequence of drinking filthy water. Of the measures adopted with the object of cutting short the outbreaks of the disease, the protection and disinfection of the water-supplies were the chief.

6. *Small-pox* accounted for 5,149 deaths, or 151 more than during the previous year. Municipal towns might have been expected to have been better protected by vaccination than rural areas; but, as a matter of fact, the death-rate in the former was more than double the provincial rate. In the former it was 0·53 per thousand of the population; and in the latter 0·25. The district of Peshawar by itself recorded no fewer than 2,288 small-pox deaths; and of these 770 occurred in the municipal town of Peshawar. On the other hand, the Kangra district "enjoyed complete immunity from small-pox throughout the year 1899-1900." Kangra is the best vaccinated, and Peshawar the least vaccinated district in the Province; the former records no death from small-pox; the latter records not far short of as many deaths as all the other 30 districts together. The result of the season's vaccination work was eminently satisfactory. Without increase to the strength of the vaccination

iment, which remained the same as in the previous year, there was an increase in the number ses of primary vaccination of 82,980, and in the number of cases of re-vaccination of 19,226. The percentage of successful cases was practically the same in primary vaccination cases as in the previous year—94·68 in the year under report and 94·84 in 1898-99. In re-vaccination cases a percentage of 62·55 was recorded, as compared 58·80 in the previous year. These satisfactory results the Sanitary Commissioner attributes to the "work being done in a more systematic way than in previous years." Judging from the statement given in paragraph 13 of the Report, the work of the vaccinators was subjected to very thorough scrutiny. Of a total of 744,917 primary vaccinations, no fewer than 685,851 were examined by the several supervising agents, and 114,532 of the total of 198,152 re-vaccinations. Experience has shown that the closest supervision is absolutely essential to prevent falsification of their records by some of the vaccinating staff. The Sanitary Commissioner writes:—"I would remark here that owing to such thorough inspection, the fudging of returns by vaccinators has been reduced to such a minimum that only two reports of irregular work were brought to my notice this year." Animal lymph was chiefly used during the year, and gave a percentage of 99·31 successful cases in primary vaccination. Human lymph, which was used in only 19,571 operations, gave a percentage of 99·37 successful cases, or almost the same as animal lymph; whilst vaseline lymph was used in 158,976 cases, and gave a percentage of 96·81 successful cases. But whilst vaseline lymph gave the lowest percentage of successful cases in primary vaccination, it gave a higher percentage than either animal or human lymph in re-vaccination. Some interesting experiments were commenced by Captain Wilkinson, the Deputy Sanitary Commissioner, with a view to ascertain the degree of protection conferred by vaccination with vaseline lymph paste; but, unfortunately, he was ordered on plague duty before he had time to complete these experiments. The Sanitary Commissioner says "Captain Wilkinson was unable to do more than make so few experiments as to prove nothing"; but he proposes that these experiments should be repeated. A return is given showing the number of children under one year of age in towns available for vaccination, and the number of successful operations performed on them during the year. From this return can be ascertained at a glance the extent to which vaccination is practised among the infant population of each town of the Province.

7. The mortality from *fever and bowel complaints* was less than in the previous year, and also less than the average for the previous five years. This result was, doubtless, as the Sanitary Commissioner observes, due to the comparative dryness of the year. The rainfall during the third quarter of the year amounted, as already stated, to only 7·77 inches against an average of 17·53 for the preceding ten years. In the Jhang District a death-rate from fever of 24·06 per thousand of population is recorded, as compared with the provincial average of 18·57. This high rate, the Lieutenant-Governor says, may or may not be due to irrigation from the recently opened Chenab Canal, and adds that no decision can be come to on this question until the figures of the next census are available.

8. Beyond stating the number of deaths reported to have occurred from *plague*, no account of the progress of that disease during the year in the Punjab is given in the Report under review. The Sanitary Commissioner has not taken up the subject, he says, because plague is reported on by the Chief Plague Medical Officer. According to the figures given in paragraph 29 of the Report, the total deaths from plague numbered only 227. The Lieutenant-Governor directs that in future the Sanitary Commissioner should give an account of the progress of plague in his Annual Report. It seems only fitting that the health report of the Province should contain some account of the progress of a disease which has given rise to so much anxiety and trouble.

9. *Sanitary Works.*—The expenditure under the heads of *drainage* and *water-supply* in municipal towns shows a large increase over that of the previous year. Under the head of drainage and sewage the amount expended increased from £6,460 to £12,956, or to more than double; whilst under the head of water-supply it increased from £11,054 to £12,470. This shows that substantial progress is being made in the promotion of sanitary works of a permanent character. An examination of Statement XI., given in the Appendix to the Report, seems to show that if much has been, and is being done in promoting sanitary improvement in municipal towns, the condition of portions of some even of the chief cities is still far from perfect. Quoting from the very useful statement referred to, it is found under the head of "Drainage," that in Delhi, the largest city in the Province, "many of the old underground drains which become blocked frequently, at all times a frightful nuisance, still exist. All these require to be replaced by surface drains. There are no drains at all in Sabzi-Mandi, Sadar-Bazaar and Paharganj districts, and drains are urgently required." But against such defects are to be set all that has been done in providing Delhi with a good water-supply and improving its drainage. The description given of Lahore, the capital and second largest city in the Province, shows that its sanitary condition approaches more nearly to the standard set up for western cities. The death-rate recorded for Delhi was 36·67 per thousand of its inhabitants, and for Lahore 32·68. The average death-rate of Delhi for the previous ten years was 40, and of Lahore 36 per thousand of its population. These figures indicate a distinct improvement in the public health of the two principal cities of the Province. The endeavour made by the Lieutenant-Governor to enlist the interest of the rural population in the improvement of the sanitary condition of their villages by the grant of rewards to the village communities showing the best results, have not, it is said, been as yet marked. This need not be wondered at in the case of people so conservative as those of India. But without the co-operation of the people themselves the effectual sanitation of the 37,602 villages of the Province could hardly be regarded as feasible; and the offer of inducements of the nature of that held out by the Government seems a reasonable means of helping to secure such co-operation.

10. *Summary.*—The year was exceptionally dry owing to the failure of the monsoon. The birth-rate, 48·4, was the highest hitherto recorded. The death-rate was 29·57, and the deaths were fewer than the births by 386,276, this number representing the natural increase of the population for the year. The increase of the population since last census, on the figures of which the birth and death-rates are calculated, has raised the recorded above the actual rates. The registration of vital statistics continues to receive much attention, and, except in the frontier districts, may be assumed to be

approximately accurate. The year was healthy. Cholera was accountable for a death-rate [illegible] 0·09 per thousand of population. Small-pox was severe only in the Peshawar District, in which it caused not far from half the total number of deaths recorded in the Province. Peshawar is the least vaccinated district in the Punjab. The Kangra District, which is the best vaccinated district, did not record a single small-pox death during the year. Vaccination made very satisfactory progress, the number of primary operations having increased by no fewer than 82,980, and the re-vaccinations by 17,266 as compared with the previous year's numbers. Fevers and bowel-complaints were less fatal than usual, owing, no doubt, chiefly to the exceptional dryness of the year, and especially of its third quarter. The mortality from plague was inconsiderable: only 227 deaths were reported as due to it. There was a large increase in the expenditure by municipalities on permanent works of sanitary improvement. The inducements held out by the Government to the village communities with the object of securing their co-operation in the cleansing of their villages, have not, it is stated, led to any marked results. But progress must be slow amongst so conservative a people, and it is too soon yet to despair of some degree of success in the future.

14th May, 1901.

No. 5.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1899.

According to the concise summary given by the Sanitary Commissioner, the year under review had a slightly higher rainfall, with higher mean humidity and lower mean maximum and minimum temperatures than its predecessor. The harvest was good throughout the Province and prices somewhat lower than in the previous year. Owing chiefly to increased prevalence of cholera, small-pox, and bowel-complaints, the death-rate was higher than in the previous year; but, on the whole, the year under review was a healthy one.

2. This year, again, the population figures dealt with in the Report have undergone a slight alteration owing to such changes, for example, as the exclusion of a portion of the Mergui district from the area under *registration*. Thus altered, the population figures are now 4,461,027, as compared with 4,510,697 in the previous year. Although a commencement has been made with the registration of vital statistics in certain towns and selected districts in Upper Burma, the Sanitary Commissioner has, wisely we think, refrained from incorporating them with the statistics of Lower Burma, and has briefly reviewed them separately, "as it has been considered undesirable to vitiate the returns of the Lower Province by their inclusion." The Government has decided not to attempt, for the present, the registration of births in Upper Burma. "Experience in Lower Burma," it is stated, "shows that the people can be brought to understand, more or less, the reason for registering deaths, but not that for registering births." After the village headmen have been for some years practised in the work of registration of deaths, the Lieutenant-Governor thinks the registration of births may also be undertaken with some hope of success. But whatever the method chosen for introducing registration of vital statistics, whether by making a commencement with the registration of deaths alone, or with registration of births and deaths together, experience in the Indian Provinces has shown that it is mainly by "constant inspection and patient instruction" that progress towards the attainment of approximate accuracy in the collection and record of vital statistics can be effected. In the words of the Government review, too much stress cannot be laid on the importance of achieving accuracy in the returns. The marked improvement in registration which has taken place under the persistent attention devoted to it, more especially during recent years, may be accepted as implying that improvement will be continuous so long as this attention is not relaxed.

3. The recorded number of *births* increased from 153,838 in the previous year to 165,229 in the year under review, giving a ratio of 37·04 per thousand of population, as compared with 34·11 in 1898, and with 31·82 in 1897. The contrast between the ratios recorded for some of the urban as compared with rural areas is striking. The Arakan urban circles record a birth-rate of only 17·31, whilst the rural areas of the same division record a rate of 34·99 per thousand of population. But the constitution of the population of the Arakan towns and country goes far to account for this difference. Whilst the urban population of the division, numbering 44,017, consists of 32,711 males to only 11,306 females, the rural population of the same division, numbering 608,036, consists of 314,185 males to 293,851 females. In the case of the towns, whilst there are approximately three males for every one female, in the case of the country the proportion of the sexes does not widely differ. In other cases where the disproportion is not so great as in Arakan, the wide divergence between the urban and rural birth-rates is probably due to defective registration. It has often been remarked that the greater the disproportion between the recorded number of births of male as compared with female children in India, the greater will generally be found to be the inaccuracy of registration. In the Arakan division the births of 109 male children were recorded against every 100 of female children. In Minbu division the proportion was only 101 of the former to 100 of the latter. But much importance need not be attached to such figures; in the previous year there were 109 male to every 100 female births in the Minbu division. In short, the more the ratios of births and deaths for the different areas are examined, the oftener will it be found necessary to fall back on defective registration to account for some of the anomalies which they indicate.

4. Along with an increase of the birth-rate there was a corresponding increase of the *death-rate*. This latter rose from 26·13 per thousand of population in the previous year to 27·30. The increase in the number both of births and deaths was, no doubt, partly due to increase of population, and also probably in some degree to improved registration. The increase of the death-rate would also be

ed by the higher birth-rate, in other words, by a larger proportion of the population being of e at which death is most likely to take place. Without apparently any purpose of furnishing mple of the movement of the death-rate, upwards or downwards, with corresponding move- of the birth-rate, the Sanitary Commissioner writes :—"The Irrawaddy division, which returned ighest birth-rate, also returned the highest death-rate (29·12); and similarly the lowest death-rate 7) was recorded for Minbu, as was also the lowest birth-rate." Male infants died at the rate of 9 per *mille* living, and female infants at the rate of 212·77. It is thus evident that the higher proportion of infants which the population contains, in other words, the higher the birth-rate the her, ordinarily, will be the death-rate. "This high death-rate amongst children," writes the nitary Commissioner, "is not peculiar to Burma, but is more or less general throughout India, specially where insanitary conditions, ignorance, and poverty prevail, for infants and young children re far more sensitive to unhealthy surroundings and morbific influences generally." He might have dded that a high death-rate amongst infants is a general feature of vital statistics all the world over, especially under the conditions he mentions.

5. *History of the Chief Diseases.—Cholera*, which, in the previous year, had been less fatal than usual in Burma, as throughout India, increased in prevalence during the year under report. Whilst n 1898 the deaths attributed to it numbered only 2,972, they increased to 4,942 in 1899, giving a ratio f 1·11 deaths per thousand of population, as compared with the ratio of ·66 in the previous year, and of ·96 the mean for the ten years 1889–98. As in the previous year, deaths due to cholera were returned during each month of the twelve. Of 16,757 villages under registration, 1,093 recorded deaths from cholera, and the average number of deaths in each of these villages due to the disease was five. The Sanitary Commissioner advances no theories of his own to account for the origin of the disease in the different localities in which it made its appearance ; and he states that, "as regards the etiology of cholera none of the district reports throw any light upon the origin of first cases." As usual, endeavours have been made to prove importation of the disease into localities affected by cholera ; but, in the opinion of the Sanitary Commissioner, in no instance has such importation been conclusively proved. The history given of the first attacks in jails is interesting. The exact facts, as far as they could be ascertained in each case are stated. Beyond the circumstance that the disease was prevalent among the free population in the neighbourhood of the jails affected, no direct connection was in any instance traced between the first case of the disease inside a jail and a case outside. Colonel Little thus sums up the history of cholera in the jails of the Province during the year : "Here we have eight groups of population under constant supervision, well-fed, well-clothed, and living under the best possible sanitary conditions, with every precaution to prevent the importation of disease, and yet, in spite of all, cholera finds an entrance and the cause of its appearance cannot be traced." Many medical officers are convinced that cholera is solely a water-borne disease, and that it is generally possible to trace outbreaks to the use of water containing the *comma bacillus*. The medical officer of the Moulmein jail reports that, though the disease was apparently imported into the jail from outside, yet "the manner of its entrance remains as mysterious as in former years, in view of the fact that every possible or conceivable precaution had been taken to prevent its entrance. The drinking water, obtained from a closed tunnel and then boiled, could not have caused it ; and it is difficult to see how it could have arisen from the food, and why one man should be attacked and several hundreds escape, living under the same conditions, and eating the same food and drinking the same water."

6. From *small-pox* a death-rate of 1·32 per thousand of population was recorded as compared with 1·07 in the previous year, and with a mean of ·56 for the ten years ending 1898. Too much importance need not, however, be attached to this apparent increase during a period when the registration of vital statistics has been steadily improving in efficiency. The importation of small-pox into Burma and its dissemination throughout the Province are attributed to the unprotected coolie immigrants, who arrive in large numbers during the harvest season for employment in reaping the rice crop. The practice of inoculation is also credited with a share in establishing foci from which the disease may be spread. A somewhat surprising statement is made in paragraph 62 of the Report. "Amongst Europeans and Eurasians in the town of Rangoon there were 139 attacks and 37 deaths from small-pox, which gives a death-rate to attacks of 26·6 per cent." One would have expected that these comparatively educated classes, running the risks of contracting the disease in Rangoon, would of their own action have taken care to be fully protected against attack by undergoing re-vaccination. After much discussion, the Burma Vaccination Law Amendment Act has been passed, and the Lieutenant-Governor trusts that the provisions of this Act will result in checking, to some extent, outbreaks of the disease, such as occurred in Rangoon during the year under report. The Act gives power in Rangoon Municipality, and in the other municipalities to which the Act may be extended, to require an unprotected person to be vaccinated ; and provides, moreover, for the compulsory vaccination of inmates of lodging-houses or coolie barracks. During the year under review, the strength of the vaccination staff of the Province was increased by the appointment of a few additional vaccinators and two inspectors of vaccination. As a consequence, there was a corresponding increase in the number of successful primary operations from 415,836 in the previous year to 432,622 in the year under report. At the same time, the number of re-vaccinations increased from 27,258 to 34,125, of which latter number 20,035 were recorded to have been successful. The percentage of successful cases in primary vaccination, 94·71, remained the same as in the previous year ; whilst there was a slight decline in the percentage of re-vaccination cases from 59·55 to 58·72. Could the accuracy of these figures be relied on, the season's work might be regarded as fairly satisfactory ; but unfortunately this is not the case. "It is very evident from district reports," writes the Sanitary Commissioner, "that there is a considerable amount of false work returned by vaccinators ; and District Medical Officers' inspections show that there is an appreciable amount of utterly incompetent vaccination, as well as a large proportion of second-rate work." Closer supervision is the remedy ; and to secure this the inspecting staff, as the Lieutenant-Governor observes, will have to be greatly strengthened. Humanised lymph is still used in Burma, and the results obtained from arm-to-arm vaccination are considered to have been good ; but the Sanitary Commissioner says there are obvious objections to this method of operation, and orders have issued that

it must be discontinued as far as possible. Complete success has not yet been attained preparation of glycerinated vaccine lymph at the Taunggyi depôt; and the partial failure lymph sent out for use seems to have been due to the free use of the perchloride of mercury antiseptic during the process of collecting it from the calf. This antiseptic, the Sanitary Commi thinks, whilst destructive of putrefactive germs, has a similar effect on the vitality of the v germs which it was intended to protect. It might be found expedient to follow the meth procedure in the preparation of glycerinated vaccine lymph which Colonel Campbell has fou yield so remarkably successful results in Assam, a province with a climate, it is believed, be some resemblance to that of Burma. The Lieutenant-Governor takes exception to the length of Vaccination Report. As he points out, a Report on Vaccination is only called for every third yea for intermediate years the returns should merely be accompanied by a brief note for their elucidation At the same time, the report now furnished, although long, is both interesting and useful.

7. The number of deaths attributed to *fevers* was somewhat less than the number recorded in th previous year. The ratio of deaths due to fever in urban areas is, as usual, less than that in rura areas. The Sanitary Commissioner thinks the explanation is to be found in the circumstance tha dwellers in the country are more exposed to malarious influences than residents in towns. Bu there are grounds for the belief that the difference between the ratio of 8·12 per thousand of th population attributed to fever in towns, and the ratio of 11·97 in rural areas, may to some exte be due to differences in diagnosis. For, if the returns of mortality are examined, it will be seen that, whilst towns show a much lower ratio of mortality from fevers than rural circles, they show, on the other hand, a much higher mortality under the heading of "other causes" than the latter. The death-rate in urban circles under the head of "other causes" is stated in paragraph 28 to be 18·63 per *mille* of population; the death-rate under the same heading for districts and towns combined is stated in paragraph 43 to be 11·33. The presumption that these figures suggest is, that many of the deaths attributed to fever in rural circles are recorded under the head of "other causes" in towns. But whilst registration is still so defective, too much weight must not be attached to reasoning of this nature. The sale of quinine is being persevered with, and the Lieutenant-Governor thinks the Sanitary Commissioner should consider whether the services of district vaccinators should not be utilised in the distribution of the drug. The mortality from *dysentery* and *diarrhœa* has remained nearly constant during the past two years, and seems to call for no special remark.

8. *Sanitary Works.*—In Burma, as in the Indian Provinces, "the main obstacle," to quote from the Government review of the Report, "to the improvement of sanitation even in the large municipalities is the lack of funds." No sanitary work of importance was undertaken during the year, but several preliminary surveys and experiments were carried on with a view to arriving at a decision regarding the kind of scheme most suitable for adoption in various towns. The postponement of useful sanitary improvements may be regrettable, but delay is preferable to hasty or ill-considered action, leading to defective results. Without the co-operation of the people of the country, little or lasting advance in sanitation can reasonably be hoped for; and before such co-operation can be secured the people will have to be educated sufficiently to enable them not only to understand and appreciate, but to be willing to pay for, the benefits to health and comfort which follow upon sanitary improvements. This education is likely to be a somewhat slow process; but without it, what of progress is made under official pressure is pretty certain to cease so soon as this pressure is relaxed. Over-activity in the promotion of sanitary improvement may occasionally lead to undesirable results. Regarding one of the districts of the Province, we read:—"Most of the rules are said to be strictly followed; in fact, some of them, especially that in connection with the cleaning up of villages, was so rigorously imposed that some officers would appear to have been guilty of harassing the villagers, headmen being ordered to fine the villagers by the score. This was promptly stopped and some of the fines refunded." Much, however, can be, and often is, done by District Officers to induce the people to cleanse their towns and villages, and especially to protect their water supplies from pollution, without having recourse to other stimulus than advice and encouragement.

9. *Summary.*—The year was, on the whole, healthy. Its rainfall was slightly higher than that of its predecessor, its humidity greater, and its mean maximum and minimum temperatures lower. The harvests were good and grain somewhat cheaper than in 1898. Registration of vital statistics is improving in Lower Burma, and is being gradually introduced into Upper Burma, although for the present only deaths are being recorded in that part of the Province. The birth-rate of the year increased from a ratio, per *mille* of population, of 34·11 in the previous year to 37·04; and along with this increase the death-rate rose from 26·13 to 27·30. The increase of the death-rate was partly due to greater mortality from cholera, small-pox, and bowel complaints; and doubtless, also, increase of population and a higher birth-rate. Cholera was more fatal than in the preceding year, when the disease was in comparative abeyance throughout the Indian Empire. An interesting account is given of the appearance of the disease in the jails of the Province. In no instance could the mode of ingress of cholera into a jail be exactly determined. Small-pox mortality was greater than in the previous year. Its importation into the Province is attributed chiefly to the coolie immigrants, who arrive annually in great numbers for employment in reaping the rice crops. Vaccination, judging from the returns, made fair progress; but doubts are thrown on the accuracy of these returns. The glycerinated vaccine lymph prepared at the Taunggyi depôt has not proved so successful as could have been desired; its partial failure appears to have been traced to the use of perchloride of mercury as an antiseptic in the process of collecting the lymph from the calf. Fever mortality was less than in the previous year. Two isolated cases of plague were removed from vessels arriving in Rangoon; but the Province has, so far, escaped a visitation of the disease in epidemic form. Lack of funds in Burma, as in other Provinces, retards sanitary improvement. No sanitary work of importance was undertaken during the year; but several preliminary surveys and experiments were carried out with a view to arriving at a decision regarding the kind of scheme most suitable for adoption in various towns.

13th May, 1901.

No. 6.

RANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the CENTRAL PROVINCES for 1899.

Like its predecessor, the year under report was a very healthy one. Its most important climatic feature was the failure of its rainfall. The immediate effect of this failure was to lessen the prevalence of malarial diseases during the last quarter of the year; its calamitous effect upon the crops and the resulting consequences to the public health of the Province will come to be recorded in the history of the following year. Although scarcity deepening into famine made itself felt during the closing months of 1899, the beneficial influence on health of the exceptional dryness of those months more than counterbalanced the injurious effects of scarcity, so that, instead of rising, the death-rate fell somewhat below that recorded during the corresponding months of the preceding very healthy year, and considerably below the mean of these months during the decennial period 1881-90. For the Province as a whole the mean rainfall of the year under report was only 24·4 inches, or less than half the mean of 51·73 for the past 33 years. In some districts the deficiency was very great. In Nagpur only 13·21 inches fell, as compared with a mean of 42·72 for the preceding 33 years; in Betul 10·72 as compared with 41·02; and in Khandwa 8·07 as compared with 30·52. This last was "the smallest ever recorded" in the Khandwa district. Considerable space is devoted to an account of the weather and crops. The consequences of the rain failure differed only in degree in the several districts. In Chindwara "the total failure of the monsoon brought on an unprecedented famine throughout the district, and relief works on a large scale were opened to save the people from starvation." In other districts the accounts given are of a similar nature.

2. The *birth-rate* recorded for the year was (excluding Chhatisgarh Zamindaris) 47·35 per 1,000 of population, against 29·91 in the previous year. As suggested in last year's memorandum the inclusion of the returns for the *zamindaris* had better have been deferred until after the taking of next census, as otherwise the vital statistics for the final three years of the inter-census period 1891-1900 cannot properly be compared with those of the first seven years of that period. The inclusion of the *zamindari* returns and the use of the estimated population figures for the calculation of births and deaths are liable, unless care be exercised, to lead to error in instituting comparisons between the statistics of the present and those of preceding years. In paragraph 6 of the Report a table is given showing the birth-rates in the different provinces of India for the years 1898 and 1899. In this table the Central Provinces are given the third place on the list with a birth-rate of 47·35; but by an oversight the death-rate has been substituted for the birth-rate in the case of the North-Western Provinces. Except for this mistake the North-Western Provinces with their birth-rate of 48·09 would occupy the third, and the Central Provinces the fourth place. Similarly, in the table in paragraph 25, the North-Western Provinces are given the last instead of the seventh place in the list, the birth-rate, 48·09, taking the place of the death-rate, 33·19. During the year every district showed an excess of births over deaths, the total excess being equal to 19·26 per 1,000 of population. A comparison of the birth-rates of the two successive years 1898 and 1899 month by month, shows that the high rates which began to be recorded in the former of these years in September continued without check until October of the latter, after which they fell away during the last three months of the year. The proportion of male to female children born was 105·29 of the former to 100 of the latter. This proportion varied in the different districts from 101·63, the lowest, to 111·68, the highest. The provincial proportion of 105·29 may be accepted as approximately normal, and some indication of good registration.

3. The *death-rates* of 31·34 and 28·81 noted in paragraph 13 of the Report are those got by using in calculating them out, not the census population figures, but those "determined by the natural increase or decrease of the population" since last census was taken. On the other hand the birth-rate, 47·2, noted in paragraph 3 of the Report, is got by using in calculating it the census population numbers and not the numbers determined by the natural increase or decrease of the population since the census was taken. There is no objection to the use of either set of population figures in calculating birth and death ratios, but obviously one set should not be used when birth-rates are calculated, and a different set when death-rates are calculated. The death-rates, "as calculated on the population according to census enumeration," are also given in the table side by side with the rates mentioned, and confusion would have been avoided had the former been noted in paragraph 13, in accord with the mention of the birth-rate, similarly calculated in paragraph 3. The death-rate of 28·09, or that obtained by excluding *zamindaris*, and using in its calculation the last census population figures, is the rate best suited for comparison with the rates for the previous years. The corresponding rate for the exceptionally healthy year 1898 was 24·30, and for 1897, a famine year, 69·34, whilst the mean annual death-rate for the period 1891-95 was 33·76. The total number of deaths during the year under report was "below the total of all years in the past decade except 1893 and 1898." One cause of the increased mortality as compared with that recorded in 1898 was the increased birth-rate. Not only was a larger addition made to the population of those in whom the liability to death is the greatest, that is to say, of infants, but the death-rate amongst these was higher during the year under report than in the preceding year. In 1898 there were 284,176 births registered; in the year under report 449,895. In the former year 59,845 infants died, giving a death-rate per 1,000 of 210·58; in the latter 103,022 infants died, giving a death-rate of 382·99 per 1,000. The latter rate, however, does not represent with even approximate accuracy the real death-rate amongst children under one year of age during the year; for, whilst the number of children of that age was only 268,732 in the census year, the number of births in the year under report was 449,895. If the former numbers are employed in making the calculation the death-rate will be found to be, as stated, 382·99; if the latter numbers are used the death-rate will be 229·99. Obviously, the death-rate

is more correctly represented by using the number of births recorded during the year for w[illegible] calculation is made, than the number of children under one year of age at the time of taking [illegible] census. If the death-rates recorded for rural areas are contrasted with those recorded for m[illegible] towns in which registration is compulsory, it might be concluded that the towns are muc[illegible] unhealthy than the rural villages, in spite of the organised system of sanitation established [illegible] former. The death-rate recorded for rural areas is 27·53, and for municipal towns 34·98. [illegible] probable, however, that, as pointed out in the Government review of the Report, the higher deat[illegible] recorded in these towns is more likely to be due to greater accuracy in registering deaths tha[illegible] greater unhealthiness. Satisfactory results do not appear, so far, to have followed the attempt m[illegible] to improve the record of the causes of death by requesting civil surgeons to make inquiries regardi[illegible] these causes. "As to the investigations made by the civil surgeons, weeks or months after th[illegible] occurrence, I regard them," writes the Sanitary Commissioner, "as almost useless."

4. *General History of the Chief Diseases.—Plague* is given the first place on the list, though as a matter of fact neither this, nor cholera, nor small-pox was the cause of a high mortality during the year. The total number of deaths attributed to these three diseases combined was only 1,724 out of a total from all causes of 266,930. Only two imported cases of plague, which proved fatal, were reported. Both came from Bombay. The remaining 582 fatal cases were indigenous, and were limited to the two districts of Nagpur and Wardah. During the preceding year, the first in which plague as a cause of mortality finds a place in the returns, the deaths recorded under this head were only 131. There has thus been a considerable increase in the prevalence and fatality of the disease in the year under report, which augurs ill for the success of the measures devised with the object of staying its further progress. It might be comparatively easy to deal with infected villages by causing them to be temporarily evacuated, but when the disease has secured a foothold in a city like Nagpur such a method of treatment becomes practically impossible.

5. The quiescence of *cholera* during the two years succeeding the destructive epidemic of 1897, when 57,131 persons were swept off by it, is a remarkable phenomenon, and one the explanation of which has not been attempted. In the year immediately following the great epidemic years 1896-97 only seven deaths were attributed to cholera, and now in 1899 only 76. But the circumstance that of these 76 cases no fewer than 64 occurred in the last month of the year seems to point to a recrudescence of the disease, and to the probability of its increased prevalence in the following year.

6. *Small-pox* has again been in comparative abeyance, only 1,064 deaths having been caused by it. As in the case of cholera, however, the occurrence of 155 deaths from small-pox in December seems to point to the probability of renewed activity of the disease in the following year. No doubt a re-accumulation of unvaccinated persons has been going on since the three severe epidemics of 1895-97 killed off, or protected the majority of those not previously protected by vaccination, inoculation, or an attack of small-pox. Vaccination made satisfactory progress during the year 1899-90. Although re-vaccinations decreased in number by no fewer than 16,311, there was an increase of 65,672 primary vaccinations as compared with the numbers recorded in the previous year. The only district in which there was a marked decrease in the number of primary operations was Nagpur, and it is explained that this was due to the vaccination staff having been employed on plague duty up to the 16th January, 1900. There was a decrease of no fewer than 11,321 primary vaccinations in this district—another illustration of the unfortunate consequences to the work of vaccination resulting from the diversion, so frequent during late years, of the vaccination staff to assist in carrying out plague measures. One of the most satisfactory features of the year's work is the large increase in the number of infants successfully vaccinated. In the previous year this number was 200,587, and in the year under report 263,584. The total number available for vaccination in the latter year was 353,992, so that there would thus remain an unprotected residum of 90,408 children under one year of age. The percentage of successful cases for the Province as a whole was 96·50 in primary operations, and 82·73 in re-vaccination. The latter percentage is, as usual in the Central Provinces, very high, and in striking contrast with that of 17·2 recorded in the adjoining province of Berar. Animal lymph was used in 276,137 operations in the various districts, according to the table given in paragraph 40 of the Report, and to supply lymph for these no fewer than 9,812 calves were inoculated. From this it would appear that each inoculated calf supplied, on the average, lymph for only about 28 children. This is less even than the number of children vaccinated from each calf in Madras city, where it was on the average 56 when used direct from the calf, and 363 when "glycerinated." In Assam, where calf lymph is preserved by admixture with glycerine, each calf supplied, on the average, sufficient lymph to charge 1,047·46 capillary tubes. If the Assam method of preparing calf lymph can be successfully introduced into the Central Provinces the resulting convenience and saving of labour and expense will be great.

7. The death-rate credited to *fevers* was 16·17 per 1,000 of population. It was thus slightly less than the rate recorded for the previous year, when it was 16·40, and less than half the rate for 1897, when it was 40·98. An examination of the mortality returns show that remarkably low death-rates from fever were recorded during the last months of the year. This was doubtless, in part at least, owing to the unusual dryness of these months consequent upon the scanty amount and premature cessation of the rainfall. The same cause doubtless contributed also to a low mortality from bowel complaints during the year. The death-rate of 1·25 attributed to *dysentery* and *diarrhœa*, though slightly higher than that recorded during 1898, was below the decennial mean of 1·41. There can be little doubt, however, that the real death-rate from these diseases was higher than the figures would indicate.

8. *Sanitary Works.*—Considerable progress was made in providing the more important towns with new waterworks and in improving the water supplies already in use. The new waterworks at Wardah have been opened, and those at Bhandara were approaching completion at the end of the year. A succession of adverse seasons, necessitating enormous expenditure in relieving the distress arising from famine, and in carrying out measures with the object of protecting the

against plague, had no doubt crippled the finances of the municipalities, and led to tponement of many useful sanitary projects. Important and much needed drainage works progress in the city of Jubbulpore. The need for a thorough system of drainage for the f Nagpur is also fully recognised, but the work is delayed owing to want of funds. The uction of a water supply into a town, if not accompanied by a drainage system capable of ing the water after it has served its uses, may render the last state of that town, from a n point of view, worse than the first. The Village Sanitation Act was extended to two e villages during the year under report, bringing the total number under the Act up to 40. perusal of the Sanitary Commissioner's remarks on the results following the introduction of e Acts into these 40 villages, leads to the conclusion that, owing to various reasons, the provisions of the Act have not been enforced with much vigour, or indeed, in some cases, enforced t all during the year. For example, in the Jubbulpore district :—"The Act has been notified as being in force in nine villages of the district, but owing to the succession of bad seasons no steps have been taken to apply its provisions as yet." In consequence of the prevalence of famine the Sanitary Board met but once during the year. As was only to be expected, "the expenditure on village sanitation fell very low. On account of the scarcity local subscriptions could not be realised, and the District Councils also could not provide in full the amounts they had allotted in their budget." The preparation of sanitary maps had been so far completed that it was proposed to commence the registration of vital statistics according to sanitary circles or units with effect from the 1st January of the year under report. "In view, however, of plague in the provinces and an empty treasury, it was decided by the Chief Commissioner that the introduction of the new system should be postponed." As with many other schemes, that of filling up Village Inspection Books has been much retarded during recent years of unusual stress. The energies and resources of the Administration have been strained to the uttermost in combating famine, and in carrying out measures for protecting the Province against plague.

9. *Summary.*—Like its predecessor, the year was healthy. Its most important meteorological feature was the failure of the rainfall. This failure did dot injuriously affect the health of the Province up to the end of the year. On the contrary, the scanty rainfall had, there can be little doubt, the effect during the concluding months of the year of lessening mortality from malarial diseases. The birth-rate was the highest recorded since 1881. The number of deaths was less than in any year of the decade excepting 1893 and 1898. The deaths from plague increased from 131 in the previous year to 584. Cholera was again in almost complete abeyance, only 76 deaths having been attributed to it. From small-pox the mortality was also again low, but the disease showed signs of fresh activity towards the end of the year. Vaccination made satisfactory progress. Animal vaccine lymph was largely used, but the number of calves required for the supply of lymph seems to have been excessive, no fewer than 9,842 having been inoculated for this purpose. The Province enjoyed unusual exemption from fevers and bowel complaints; the consequence, it is believed, of the exceptional dryness of the year, and especially of its last quarter. The limited funds available for sanitary works were expended chiefly in improving water supplies and drainage.

14th May, 1901.

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1899.

Accepting the observations taken in the three selected districts for which observations are recorded, as representing the general meteorological conditions which prevailed in the Province, the year under report appears to have been an unusually cool one. In two of the selected districts the rainfall was, in the one, very much greater than the average; and in the other about or slightly above the average; whilst in the third it is stated to have been, excepting in 1898, the lowest on record. Accompanying these weather conditions there were good harvests and cheap food supplies. Judged by its record of mortality the year was a comparatively healthy one.

2. "No change occurred in the areas in which vital statistics were collected, but the returns of Kohima station, and the selected areas in the Garo Hills have, for the first time, been included in the provincial returns." The population numbers of last census, 5,050,590 are those on which ratios of births and deaths still continue to be calculated. No doubt these figures have ceased to represent with accuracy the present population of Assam. If the population has increased since last census was taken, this must be due to immigration, and not to the excess of births over deaths, that is to say, to "natural increase." An examination of the returns shows that, whilst for the ten-year period 1887-96 the average annual number of births recorded was 148,725, the average annual number of deaths was 149,407. In the three years 1897-99, taken together, the deaths exceeded the births by over one hundred thousand. But too much need not be made of these figures whilst the registration of births and deaths remains, as it still is, imperfect. Assuming, however, that births and deaths are recorded with equal inaccuracy, it would appear that there has been not only no "natural increase," but a decrease of the population numbers since last census was taken. Possibly this decrease may have been more than compensated for by the annual immigration of labourers for employment on tea estates. The coming census may be expected to clear up such uncertain points, and to show definitely whether, and to what extent, the population has increased or decreased during the preceding 10 years. The Chief Commissioner reiterates the caution that the figures of the returns

are nearly everywhere incomplete. He is of opinion that conclusions of a scientific value [illegible] be drawn from them for comparative purposes, and that even in this respect inferences are [illegible] to be mistaken.

3. The *birth-rate* shows a marked increase over that recorded for the previous year, and li[illegible] over the average for the 10 years ending 1896. Still, a recorded birth-rate of 35·45 during a y[illegible] remarkable fecundity throughout India cannot represent the real birth-rate, which when norm[illegible] estimated to be not less 48 per 1,000 of population. Excepting in the Madras Presidency, where r[illegible] tration is still very defective, the Assam birth-rate is the lowest recorded in any of the chief Ind[illegible] Provinces for the year under report. That the recorded birth-rate is largely a question of the great[illegible] or less efficiency of registration seems probable from an examination of Table 2 of the Report. O[illegible] the six districts of the Brahmaputra Valley only one returns a birth-rate exceeding 40 per 1,000 of it[illegible] population. The district of Goalpara records a rate of 41·43; and Nowgong a rate of only 21·01. Th[illegible] Goalpara district is the only one of the six in which registration of births and deaths is affected by[illegible] paid village watchmen, "with the result," as stated in last years' *memorandum*, "that the work is[illegible] more efficiently performed than in any of the other districts of the same group." An additional[illegible] reason assigned in a previous report for the more complete record of vital statistics in Goalpara wa[illegible] the great interest taken in registration by the Superintendent of Police of that district. Such facts[illegible] seem to lead to the conclusion that in Assam the birth-rate recorded in different districts of the[illegible] Province varies in accordance with the greater or less efficiency of the agency entrusted with the collection and record of vital statistics. In his report for the year 1895, the Sanitary Commissioner wrote:—"There is little doubt that in 1895 not less than 30 per cent. of the births in this Province were not registered." Registration has improved since that remark was made; the birth-rate for 1895 was 31·00; whilst for the year under report it is 35·45. Yet the latter figures fall very far short of those which are estimated to represent the normal rate per 1,000 of population.

4. The *death-rate* was the lowest recorded during the five years ending 1899, and was, at last, below the birth-rate. The number of deaths registered was 156,595, giving a ratio per 1,000 of population of 31·01 as compared with 179,027 births, and a birth-rate of 35·45. Instead, therefore, of the deaths being in excess of the births, as in the two preceding years, by over 100,000, the births exceeded the deaths by 22,432. But there can be no question that the number of deaths recorded is far below the actual number. In a year with a high birth-rate, a high death-rate was to have been expected, seeing that the mortality amongst children in their first year of life is nearly always far higher than amongst an equal number of persons during any subsequent year of life. The higher the proportion, therefore, which the portion of the population in the first year of life bears to the total population, the higher will be the death-rate. In other words, under ordinary conditions, the higher the birth-rate the higher will be the death-rate. It is quite certain that the recorded death-rate amongst infants under one year of age, which the Sanitary Commissioner regards as indicating an "extraordinarily great" loss of life, is very far from representing the entire loss. During the year under review the death-rate per 1,000 of children born is recorded to have been 186·39. As the Chief Commissioner points out, these figures, instead of being considered to be remarkably high, should rather be characterised as low. In Goalpara, the district in the Brahmaputra Valley in which registration of vital statistics is acknowledged to be the most efficiently carried out, the recorded death-rate amongst infants under one year of age was 296·46. In no other district of this region did the rate reach 200 per 1,000 of the children born, and in one of them it was only 96·32. "The truth is," as the Chief Commissioner writes, "that infant mortality in India is much higher than is commonly supposed, and it is principally under the head of infant mortality that registration is defective." In the districts in which it is effected through paid village watchmen, registration has greatly improved. Strenuous efforts are made to see that the watchmen do not neglect this part of their duties. No fewer than 830 of the paid staff of watchmen were punished for neglect to report births or deaths in the three districts of Sylhet, Cachar, and Goalpara; whilst in the rest of the districts of the Province, where unpaid agents known as *gaonburas*, are employed, only 34 were punished for such neglect. It may be difficult, or inexpedient, to punish men for the neglect of duties for the performance of which they receive no remuneration. However this may be, the results obtained in the two classes of agents are widely different. Where paid watchmen are employed to collect vital statistics, and are strictly supervised, the work is comparatively well done; where unpaid *gaonburas*, or village headmen, who probably cannot be strictly supervised, are employed, the work is badly done. The registration question in Assam, as elsewhere, is no doubt mainly a financial one.

5. *General History of Chief Diseases.*—The mortality from *cholera*, which had decreased from 33,754 deaths in 1897 to 11,288 in 1898, further fell to 8,380 in the year under report, and was less than half the average for the ten-year period 1887–96. In the very full account given by the Sanitary Commissioner of the history of the disease for the year, allusion is repeatedly made to the connection between outbreaks in different parts of the Province, and the batches of immigrant coolies who mostly came up by river to work on tea gardens. In the first paragraph dealing with cholera it is stated:—"There was a slight outbreak in both valleys in November and December, owing chiefly to deaths amongst immigrant coolies, otherwise the disease might almost have been called non-existent." Regarding the outbreak in the Goalpara district, "it apparently originated in the river-side depôts amongst batches of infected tea garden coolies, who then spread it about." In the Darrang and Sibsagar districts the tea-garden coolies suffered most. Of Lakhimpur it is stated: "There was practically no cholera in the district, but the tea gardens reported 212 cases, which brought the district rate up to 1·00; were these omitted the rate would be 0·017 only." And, finally, we read in paragraph 44:—"The incidence of the disease on tea gardens is always more severe than elsewhere; in fact, epidemics frequently start from them, and as most batches of coolies coming up by steamer or rail are infected, it is no wonder the managers cannot keep their estates clear." It might be gathered from these remarks that if the stream of coolies, which flows annually into the Province, were cut off, cholera would largely disappear. Unfortunately, no reliable statistics are available from which any conclusions can be drawn regarding the comparative prevalence of cholera in Assam before and after the opening out of tea gardens, which led to the introduction of coolies from

inces. But there is evidence that the disease is not always imported by immigrants. In up district cholera is stated to have been "endemic" in some circles throughout the year. gard to the river-side population of this district the Sanitary Commissioner writes:— ms impossible to keep the river-side population from drinking the water in dirty and d back-waters and semi-stagnant rivers, and so I suppose the disease will always be present it may vary in activity from time to time." From this statement it may be assumed s the disease prevails endemically in the Province, outbreaks may occur which cannot be l to the introduction of infection by immigrant coolies. Moreover, it is doubtless the case that, st, owing to the more thorough supervision to which they are subjected, tea-garden coolies rarely ever suffer from cholera without the fact being reported and a record made of the resulting ortality, cases of the disease may occur among the general population of the Province and escape otice. The table given in paragraph 7 of the review of the Report by the Chief Commissioner, hows that only 72 cholera deaths occurred during the year on "steamers and at depôts among coolies oming up the Brahmaphutra Valley." Regarding the recrudescence of the disease at the close of the ear, which, as already noted, the Sanitary Commissioner attributes chiefly to deaths among mmigrant coolies, the Chief Commissioner says:—"This did not occur among immigrant coolies, as s incorrectly stated in the Report." Importation of infection seems so simple an explanation of utbreaks, that there may occasionally be some risk of exaggerated importance being assigned to it nd of local causes being overlooked.

6. *Small-pox* was less fatal than it was in either of the two preceding years, and the death-rate of 0·31 attributed to the disease was lower than the average for the ten years 1887–96. The single district of Darrang contributed by far the greater number of the small-pox deaths which occurred in the Province during the year under report. This district is contiguous with that of Nowgong, which suffered from a violent small-pox epidemic in the previous year, and from which the disease may have spread into Darrang. The Sanitary Commissioner writes of "the terrible epidemic in Nowgong during 1898 having been quite stamped out." But perhaps it would have been more correct to have described it as having burnt itself out. In this district owing to their bigoted objection to vaccination, the inhabitants are very insufficiently protected against small-pox; and the epidemic just ended would not seem to have led to an increase, but rather to a decrease in the number of persons who underwent vaccination. During 1897–98 the number vaccinated in the Nowgong district was 19,630; next year, when a destructive epidemic of small-pox prevailed, the numbers fell to 9,347 or to less than half; whilst in the year under report they were still as low as 10,259. The vaccination staff of the Province was practically of the same strength as in the previous year. The number of vaccine operations performed by all agencies increased from 258,905 in the previous year to 272,265 in the year under report. The percentage of success in primary vaccination was 98·50, or almost the same as in the previous year; whilst in re-vaccination it fell from 93·78 to 88·90. "As the primary work becomes more and more thorough," writes the Sanitary Commissioner, "re-vaccinations will tend to show a smaller percentage of success." To some extent this may be true; but the difference in the quality of the primary vaccination in different provinces would not account for the return, for example, of a percentage of less than 20 in Calcutta and less than 30 in Berar; whilst Assam, the Central Provinces and Madras return percentages of from 80 to 90. These wide differences are probably to be explained rather by assuming that the standard by which cases of re-vaccination are decided to be successful or unsuccessful is not everywhere the same. A satisfactory feature of the season's work is the increase in the number of children under one year of age who were vaccinated. In the previous year this number was 50,389; in the year under report it was 61,793. It will be noted, however, that even the latter figures fall very far short of the number of births registered during 1899. After deducting the deaths of children under one year of age from the number of registered births, there would still remain available for vaccination 145,647. A good many of those would probably not be in a fit state to be vaccinated; but even when full allowance has been made for these, at least half the number of infants under one year would remain unvaccinated. The quality of the vaccine lymph supplied from the depôt at Shillong continued to be excellent. Colonel Campbell, the Civil Surgeon, appears to have successfully overcome the difficulties which other Medical Officers in India have hitherto found to be insurmountable in their endeavours to preserve unimpaired the activity of calf lymph by mixing it with glycerine. Prepared by Colonel Campbell's method, lymph which had been kept in the depôt for over six months for experimental purposes "was as efficacious as at the time of manufacture." In an interesting account given of his experiments Colonel Campbell describes his method of vaccine lymph preservation. It seems to be simple; and unless the climate of Assam is specially favourable to its success, and the climates of other provinces unfavourable, there appears to be no reason why his method should not be adopted throughout India. Colonel Campbell writes:—"Two thousand tubes manufactured on the 11th February and 15th February 1900 were forwarded to the Principal Medical Officer and Sanitary Commissioner, Assam, to be kept for experiment next season. This will be an interesting experiment to see if lymph will keep in the plains through a hot weather if not exposed to sunlight or heat, *i.e.*, if simply shut up in a wooden box. I believe this will prove to be the case."

7. The mortality from *fever*, including that description of it known as *kala-azar*, has greatly diminished during the past two years, but is still higher than the average for the decade 1887–96. In the year under report the death-rate from this cause was 18·04 per 1,000 of population, as compared with 20·95 in the previous year, and with 28·72 in 1897. Of the total recorded number of 91,096 fever deaths in the Province, 14,246 are differentiated as *kala-azar*. In three districts only was this form of fever reported to be very prevalent; and in these it is probable that many cases of ordinary malarial fever have been included in the returns as *kala-azar*. "There is a natural tendency in tracts where *kala-azar* prevails to class all deaths from fever under that head, and no reliance can be placed on local diagnosis." This tendency to mix up in the returns *kala-azar* and ordinary malarial fever need not be wondered at, seeing the close relationship which the weight of expert opinion appears to have established between them. Of a total of 9,111 deaths from fever in the Nowgong district, all except 919 are ascribed to *kala-azar*. Of *kala-azar* the Sanitary

Commissioner writes :—"On the whole the epidemic may be said to be surely, if slowly, ce[illegible] whether it will disappear without infecting the Sibsagar and Lakhimpur districts is m[illegible] anyone can predict." With diminished fever prevalence the sales of quinine fell off; on[illegible] packets having been sold, as compared with 3,750 in the preceding year.

8. *Sanitary Works.*—Although no sanitary works of magnitude were undertaken during th[illegible] the list of useful minor sanitary improvements carried out in municipalities, unions, station[illegible] towns is a long one. Attention was more especially devoted to the improvement of the [illegible] supplies and to clearing out the repairing drains. The question of the disposal of night-soil o[illegible] special difficulties in Assam. When suitable ground is available near towns the *trenching* system probably the best. But the people obstinately refuse to cultivate land in which night-soil has bee[illegible] trenched. Under these circumstances the Sanitary Commissioner suggests the employment [illegible] incinerators for burning night-soil. But to this, likewise, the municipalities strenuously object owing to the difficulty of overcoming the unpleasant odours given off when such refuse is being burned. Village sanitary improvement is mainly confined to the construction and repair of wells and the excavation and deepening of tanks. There is probably no way in which the limited funds available for rural sanitation could be laid out to better advantage. Village sanitary inspection books were maintained in selected villages and submitted to Civil Surgeons with more or less of irregularity during the year. Some of the Civil Surgeons do not regard the entries in these books as being of much practical value.

9. *Summary.*—The year was a comparatively healthy one. It was exceptionally cool. Harvests were good and food cheap. The birth-rate, which during the two preceding years had been lower than the death-rate, exceeded the latter by 4·45 per 1,000 of population. Deaths from cholera decreased from 33,754 in 1897 to 11,288 in 1898; and now in the year under report to 8,380. The Sanitary Commissioner traces a connection between outbreaks of the disease and the arrival in the Province of batches of coolies recruited in other provinces for employment in the Assam tea gardens. Small-pox was less fatal than in either of the two preceding years. Vaccination made good progress, and a satisfactory feature of the season's work was a substantial increase in the number of children under one year of age who were vaccinated. The quality of the vaccine lymph sent out from the Shillong depôt was excellent, and the percentage of successful cases following its use was high. Colonel Campbell, the chief Surgeon of Shillong, appears to have succeeded in preparing a mixture of vaccine lymph with glycerine and water which retains its activity for months. Fever was much less prevalent and fatal than in either of the two previous years. The form of it described under the name of *kala-azar* is believed by the Sanitary Commissioner to be slowly but surely ceasing in the Province. He adds, however, that, whether it may extend to Sibsagar and Lakhimpur districts, no one can predict. No sanitary works of magnitude were undertaken during the year; but much attention was devoted to the improvement of water-supplies and drainage in municipalities. Rural sanitation was promoted to the extent to which the funds available permitted.

14th May, 1901.

No. 8.

Memorandum by the Army Sanitary Commissioner on the Medical and Sanitary Report of Coorg for 1899.

The health of this small Province was better than it had been during either of the two preceding years. The rainfall was less than usual: only 91·12 inches of rain was measured as compared with 122·67, the mean of the previous five years. The mean temperature of the year was 68·5; and the maximum on any one day did not exceed 88·50. The staple food grains were somewhat, though not much, cheaper than in the two preceding years; but they are still very much dearer, especially *raggi* and *gram*, than in the years preceding 1897. In 1896, 25 seers of *raggi* could be got for a rupee; and in the year under report only 19·7. The price of common rice appears to vary little from year to year.

2. The recorded number of *births* increased from a total of 2,795 in the previous year to 4,427 in the year under review; and the birth-rate from 16·15 to 25·59 per thousand of population. The peculiar constitution of the population of Coorg results in an abnormally low birth-rate being annually recorded. Of the total population, numbering according to last census 173,055 persons, about 50,000, or more than a fourth, are immigrant coolies who come to work on the coffee estates for six or seven months of each year. As these coolies are rarely accompanied by their wives, they contribute little or nothing towards the birth-rate; whilst they form more than a fourth part of the population on which the birth-rate of each year is calculated. As they do not contribute to the births of the year, their numbers should be deducted from the population figures on which the birth-rate is calculated. If this is done, the abnormally low birth-rates hitherto recorded in Coorg would disappear, and give place to rates more in harmony with those prevailing in other provinces. If the 50,000 immigrant coolies are deducted from the census population figures, Colonel Bain shows that the birth-rate of only 25·59 recorded for the year under report becomes 35·97. But even when the birth-rate has thus been brought more into line with that elsewhere recorded, some peculiarities remain unexplained. In other provinces the percentage of male children is in excess of the percentage of female children born. In Coorg the reverse is the case: the percentage of female exceeds the

of male births. In the year under report, for every 100 female children born only 95·8 e born. In the Madras Presidency the proportion was 103·9 male to every 100 female born.

Whilst the number of births increased, the number of deaths decreased. The death-rate for the ious year was 31·44, and in the year under report 28·00. The increased mortality amongst ren under one year of age is a noticeable feature of the returns for the year. In the previous 742 children of less than a year of age died : in the year under report the number rose to 1,024 ; yet the latter was the healthier year. The death-rate amongst male children under one year of ose from 187·02 per thousand living in 1898 to 251·42 in 1899 ; and amongst female children of same age, from 157·08 to 223·18. Possibly, the explanation of this greater mortality amongst ants during the healthier year of 1899 may be due to improved registration of births. "Excluding ants," writes Colonel Bain, "3,161 deaths out of a total of 4,845 for the Province occurred between e ages of 20 to 50, which represents the working period of life, and this again shows that the large ortality is due to the influx of coolies." The Chief Commissioner has directed that the deaths mong the immigrant coolies shall be registered separately from those among the indigenous opulation of the Province. The figures for 1900 tabulated under the new system cannot fail, he hinks, to be instructive.

4. *Chief Diseases.—Cholera* was entirely absent from the Province. *Small-pox* accounted for 28 eaths : this would give a ratio of 0·16 per thousand of population. Since the severe small-pox pidemic of the years 1891-93, the death-rate from this disease has in no year reached 1 per thousand f the population. Vaccination, the progress of which had been greatly retarded during the previous ear by the plague-inoculation scare, recovered most of the ground then lost. The total number of ersons vaccinated and re-vaccinated by all agencies during the year under report was 10,477, as ompared with 5,673 in the year 1898-99. The figures for the year 1897-98 were, however, higher han those for the year under report by 500. In all vaccination operations calf lymph alone was used. The percentage of success obtained by the regular establishment was 94·93 in primary vaccination, nd 76·48 in re-vaccination. The percentage of success recorded in the 481 cases vaccinated at the lispensaries was only 75·40 in primary vaccinations, and 55·23 in re-vaccinations. Of the total population of the Province, 54·69 were protected by vaccination, as compared with only 29·46 in the previous year. According to Vaccine Statement A in the Appendix to the Report, the number of children under one year of age who were successfully vaccinated was only 800. The great majority, 4,825, of those who were successfully vaccinated, were over one year and under six years of age. These numbers are exclusive of dispensary vaccination cases.

5. Under the head of *Fever*, the greater part of the mortality of the year was, as is usual, recorded. The death-rate attributed to this cause was 23·10 of a total of 28 per thousand from all causes. Doubtless, in Coorg as in other provinces, deaths from a variety of other diseases are entered under the head of fever. As compared with the fever death-rates recorded for the previous two years, the rate for the year under report shows a marked decrease. In 1897 the death-rate from this cause was 41·50, in the year following 27·02, and now 23·10. This lessened fever mortality probably bore some relation to the diminished rainfall of the year. A similar connection probably existed between a drier season and a marked decrease in the mortality from *diarrhœa and dysentery*. The death-rate attributed to these two diseases was 0·64 per thousand of population, against a mean of 1·85 for the previous five years. The Province "providentially escaped the plague, although it crept up almost to the frontier on the Mysore side."

6. The sections of the Report dealing with jails, dispensaries, and sanitary works, need little notice. The health of the prison population is described as having been "good" ; but this does not seem quite consistent with the figures given in Statement No. XIV. of the Appendix. From those figures it appears that, out of an average daily strength of 110·49 prisoners of all classes, 14 died during the year, giving a death-rate per thousand of strength of 126·71. As might have been expected, the attendance at the dispensaries fell off during so healthy a year ; the total number of patients treated having decreased from 41,396 in the previous year to 33,753 in the year under review. The number of surgical operations fell at the same time to 473. Some useful sanitary works were carried out during the year. Doubtless the funds available for such works were much reduced by the cost of the arrangements which were considered necessary for the defence of the Province against threatened invasion by plague.

7. *Summary.*—The sanitary history of the year was uneventful. The health of the population was better than it had been in either of the two preceding years. A disturbing element in the vital statistics of Coorg is the immigrant coolie section of the population. These coolies, who annually enter the Province and remain on the coffee estates for six or seven months, do not bring their families with them, and do not, therefore, contribute to the birth-rate, whilst they add largely to the death-rate. The result is the annual record of an abnormally low birth-rate and of a high death-rate. The Chief Commissioner has directed that in future the deaths amongst these immigant coolies shall be registered separately from those occurring amongst the indigenous population. The birth-rate recorded for the year was 25·59 ; but if the 50,000 immigrant coolies are deducted from the population numbers when calculating the birth-rate, the result would be 35·97 instead of 25·59. The death-rate fell from 31·44 per thousand of population in the previous year to 28·00. The decrease was doubtless due, in part, to the fact that the year was drier, and probably, therefore, healthier than either of its two predecessors. The decrease in the number of immigrant coolies employed on the coffee estates during the last six months of the year, owing to the depressed state of the coffee industry, likewise contributed to lessened mortality. Cholera was entirely absent throughout the year ; and small-pox accounted for only 28 deaths. Vaccination made satisfactory progress, recovering most of the ground lost in consequence of the unfortunate plague-inoculation panic, which had brought operations to a standstill for some months of the previous vaccination year. Fever and bowel-complaints were less fatal than usual, a result which may, perhaps, be credited to the exceptional dryness of the year. Plague was

successfully excluded from the Province, notwithstanding that it closely approached [illegible]. The health of the prisoners is said to have been good; although the jail mortality ret[illegible] hardly consistent with this statement. As was to be expected in so healthy a year, t[illegible] dimished attendance at the dispensaries. The number of surgical operations likewise considerably.

14th May, 1901.

No. 9.

Memorandum by the Army Sanitary Commission on the Rajputana Sanitary, Vaccination, Dispensary and Jail Report for 1899.

Along with the Report itself, the Army Sanitary Commission have been favoured with a copy of a note on it by the Director-General, Indian Medical Service. In this note the importance of registration as constituting "the fundamental basis of all fruitful sanitary effort" is insisted on, and the need for its improvement, more especially in the Native States, shown to be urgent. Further, the relation demonstrated by recent research to exist between malarial fevers and mosquitos is discussed and medical officers and subordinates enjoined to aid in the collection of information regarding the distribution in time and place of the varieties of mosquitos concerned in the propagation of fever. The note ends with a brief commentary on the progress of vaccination in Rajputana. The Director-General's review embraces the chief points dealt with in the Report, and any additional remarks which the Army Sanitary Commission may have to make need, therefore, only be of the briefest.

2. The year under report was, like its predecessor, one of deficient rainfall. At Ajmer only 1[illegible] inches of rain were registered, or less than half the average fall for the previous six years; and in Bewar only 5·10, against an average of 22·75. In the Western States of Rajputana and Bikaner there was no rain worth mentioning. In consequence of this failure of the rainfall, the crops withered, and the tanks and wells dried up. Under the influence of abnormally high prices of grain and scarcity of good drinking water, the death-rate, which in Ajmer-Merwara had been 22·13 in the previous year, rose to 33·21 in the year under report, per thousand of population.

3. In our memorandum for 1898 that year was described as having been a "comparatively healthy" one. The *birth-rate* of 1899, influenced as it of course was mainly by the conditions which prevailed during the preceding comparatively healthy year, rose from 29·73 per thousand of population in 1898 to 31·40; but this was still below that recorded for 1897, when it was 33·69. It is pointed out in the review of the Report by the Agent to the Governor-General that there is a remarkable difference between the birth-rate recorded for Ajmer and that for Merwara. In the former it was only 29·39 and in the latter 38·4. This wide difference is attributed to the unsatisfactory condition of registration in the Division.

4. The marked increase of the *death-rate* in Ajmer-Merwara from 22·13 in the preceding year, to 33·21 in the year under review, is attributed by the Administrative Medical Officer to deaths among people who had immigrated on account of famine from the neighbouring Native States. All of the principal diseases were more fatal than in the previous year. Cholera was, however, practically absent from Ajmer-Merwara, only three cases with one death having been attributed to it, as compared with no deaths in 1898. But in five Native States there were 846 cases, and 497 deaths from cholera, as compared with only six cases and six deaths in the previous year. Small-pox deaths more than doubled in number, as did also the deaths from diarrhœa and dysentery. Mortality from bowel complaints was doubtless increased by the scarcity of good drinking water, and the insufficiency or unsuitableness of the food available during a season of distress. Regarding the water supply of Ajmer city, the Administrative Medical Officer says that the lake from which this is obtained dried up altogether owing to the scanty rainfall for two successive years; but he adds that the discomforts of a water famine were averted by the introduction by pipes of a supply from another lake. "The water of both lakes," he remarks, "has been condemned by the Chemical Examiner, but it is excellent nevertheless."

5. That *Sanitation* is receiving attention in Rajputana is made clear by the detailed account given of its progress in all the important States. "Protection of the water-supply, regular cleansing of cities and towns, and surface drainage, are receiving much more attention than hitherto." Village sanitation is not overlooked; but until the rural population is better educated than at present, much permanent improvement in the sanitary condition of their villages can scarcely be looked for.

6. The numbers *vaccinated* during the year show a considerable increase over those for the previous year; but in some of the Native States little is yet being done, it is said, to mitigate the ravages of small-pox. Humanised vaccine lymph is still generally used, although buffalo calf lymph, it is stated, was used as much as possible. This year, again, the percentage of successful cases in certain Native States is phenomenally high. In five of these States all of the cases of primary vaccination were successful. In Kotah the primary vaccinations numbered 24,244, and every one of these, according to Annual Statement I., proved successful. Yet, to quote from the Report, "the inspection of vaccination work during the year received vigilant attention from the various Agency Medical Officers."

7. The *dispensaries* at the close of the year under review numbered 165, as compared with 157 at the end of the previous year. The number of indoor patients nearly doubled, and that of outdoor patients showed a considerable increase. As usual, malarial fevers and spleen diseases were the most

ments treated. There was, however, a marked decrease in the number of admissions rial fevers, due, no doubt, to the unusual dryness of the year, consequent upon the failure of On the other hand, "the deaths from diarrhœa and dysentery were more numerous than evious year, and these diseases would naturally be more fatal among a population reduced erior food and scarcity than a year of plenty." The water famine following the failure of the doubtless contributed to the increased prevalence and fatality of bowel complaints. The sale nine diminished by half, and this is attributed to lessened prevalence of malarial fevers; but npoverished condition of the people during a year of scarcity and high prices may also have ts share in diminishing the sales of quinine by lessening the ability of the people to purchase it. ast amount of surgical work was done; the number of operations increased both in the Ajmer-wara Division and in the Native States. In the former these rose from 3,019 in the previous r to 3,197, and in the Native States hospitals and dispensaries from 61,470 to 62,213. The preva-ce of leprosy in Rajputana continues to diminish. "No cases of indigenous bubonic plague urred in Rajputana during the year 1899."

3. Owing to the prevalence of famine, crime increased, and the average number of prisoners in the l at Ajmer, and in the twenty jails in Native States rose, in the case of the former from 287·74 in e previous year, to 371·70; and in the case of the latter from 4,679·58 to 5,194·51. The death-rate the Ajmer jail remained at nearly the same level as in 1898, showing, however, a slight decrease; it in the jails of the Native States the death-rate, which had been only 19·23 in the previous year, se to 29·84 per thousand prisoners. Under the conditions of famine and water scarcity which aracterised the year, the only wonder is that the death-rate did not largely exceed the latter figures. f the deaths in the jails of the Native States 35 per cent. were due to dysentery and diarrhœa. he Administrative Medical Officer attributes the increased death-rate in these jails "partly to over-owding and partly to the weak state of health of many of the prisoners on admission." It is tisfactory to learn that the construction of new jails in Banswara and Pertabgarh on healthy sites under contemplation. The high death-rate recorded in the former of these jails has hitherto epeatedly attracted attention.

9. *Summary.*—Accompanying the Report there is a note by the Director-General, Indian Medical Service, briefly reviewing it. The failure of the rainfall, which was also a marked feature of the previous year, recurred in a more aggravated form during 1899. Not only did grain crops and fodder for cattle wither, but the lakes and wells dried up. The birth-rate, influenced mainly by the comparative healthiness of the previous year, showed some increase. It was only to be expected that scarcity of food and good water should have the effect of raising the death-rate. Sanitation continues to receive attention both in towns and villages; but progress is not likely to be rapid until the return of more prosperous times. The numbers vaccinated show a decided increase. The same phenomenally high percentages of successful cases hitherto recorded in Native States continue to be a striking feature of the vaccination returns. Famine brought with it, as usual, increase of crime and a more crowded state of the jails. The death-rate amongst the prisoners as a whole was not, however, excessive. It is satisfactory to note that some of the more unhealthy of the jails in Native States are to be replaced by new ones.

5th July, 1901.

No. 10.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of MADRAS for 1899.

As in the previous year, the Report of the Sanitary Commissioner is submitted to the Government of the Presidency by the Sanitary Board, together with the Board's own Report and the Report of the Sanitary Engineer. In the same volume are thus included three reports, each of which receives a separate notice in the Government review. The Sanitary Board, one of the chief functions of which is to consider the various sanitary schemes submitted to it, and to advise and decide as to their fitness for being put into execution, scrutinised during the year under report plans and estimates of 114 sanitary works of the total estimated value of nearly 20 lakhs of rupees. The Board does not confine itself to an examination in the Board-room of the plans and estimates laid before it: when considered expedient its members assemble on the site of the proposed works and form their opinions regarding them, from observations made on the spot. On at least two occasions, the latter procedure was followed during the year. As might have been expected, the Board's Type Designs of buildings are found of use beyond the limits of the Madras Presidency. "Many of them," it is stated, "have been found too expensive for the minor bodies of the Presidency, and the Sanitary Board is now arranging for the preparation of cheaper designs for various buildings."

2. From a meteorological point of view, the most important feature of the year was its rainfall. Compared with an average of 45·72 inches for the 10 years ending 1896, the rainfall recorded during the year under review was only 21·92 inches, or less than half for the Presidency as a whole. The effect of this deficient rainfall upon the prices of food grains was not marked until the last quarter of the year, when the failure of the north-east monsoon made it certain that this would be followed by a bad harvest. The table given on page 23 of the Report shows that in two selected districts, the staple grains, taking their average price for the whole year, were much cheaper than in either of the two preceding years. In the last three months, however, with the prospect of crop failure and with

grain being bought up for other provinces overtaken by scarcity or famine, prices What of adverse influence this rise in the price of food during the last three months of th have exercised on the public health, was probably more than counterbalanced by the unusu succeeding to failure of the north-east monsoon. As judged by its death-rate, the year was le than its predecessor.

3. *Registration* of births and deaths, hitherto, and still, a weak feature of the vital statistics Madras Presidency, is receiving ever increasing attention. The introduction of the "Madras Reg tion of Births and Deaths Act" of 1899 may be expected to hasten improvement. One of obstacles in the way of the successful working of this Act is said to be the difficulty in findin sufficiently educated staff to undertake the duties of registrars. As the Sanitary Commissioner s the creation of a specially organised staff "would create financial difficulties, not likely to be ov come." According to the last census figures, the population of the Presidency exceeds thirty-f and a half millions; but for upwards of two millions of these, no vital statistics are yet collect By degrees, however, registration of births and deaths is being extended to the entire populati The Sanitary Commissioner illustrates by examples the ill effects of undue leniency in the admini tration of the rules for obliging the inhabitants of municipalities to register births and deaths. I most of the sixty municipal towns of the Presidency penalties were inflicted for breach of the rules; but in a few, the record of prosecutions for failure to carry out the rules is blank, and i these latter poor registration results are usually obtained.

4. In the Madras Presidency, as in some of the other Indian Provinces, the *birth-rate* for 1899 w the highest on record. From a ratio of 24·6 per 1,000 of population, in the previous year, it rose t 31·3 in the year under review. This increase in the birth-rate was probably due to a combination causes. A table is given showing that, excepting in 1896 and 1897, when the number of birth decreased in sympathy with the prevailing conditions of scarcity or famine, there has been a steady increase in the birth-rates registered from 25·1 in 1892 to 31·3 in the year under report. This increas the Sanitary Commissioner attributes "to better attention to registration by all concerned." It is also shown that the increase of population since last census has necessarily tended to raise the recorded above the actual birth-rate. If the birth-rate is got by using, in calculating it, the lesser population numbers of last census, instead of the greater population numbers of the year yielding the births, it is obvious that the real rate will not be obtained. The exact population numbers of the year under report are not obtainable; but taking the estimated numbers and calculating therefrom the birth-rate, it will be found that this is considerably less than the recorded rate. Using the census population figures, the birth-rate for the year works out to 31·3; and using the estimated population figures to only 27·4 per 1,000. In addition to these two causes which tended to raise the birth-rate, there was yet another. In the Madras Presidency, as in other Provinces in which the population underwent distress from scarcity of food, the depression of the birth-rate following, and doubtless chiefly, if not entirely, due to this distress, was succeeded by reaction. The return of prosperity in succession to a period of distress was followed in due course by a remarkable increase in the number of children born. Some part of the decreased fecundity in hard times may perhaps be explained by assuming that marriages are then postponed until the return of prosperity. And, similarly, some part of the increased fecundity of a period of prosperity succeeding a period of distress may be ascribed to the taking place of marriages which had been postponed until the season of distress had passed. But to whatever cause, or causes, it is due, reaction from an abnormally low to an abnormally high birth-rate seems ordinarily to characterise a season of prosperity succeeding a season of scarcity.

5. The total number of deaths gives a ratio of 20·1 per *mille* on the census population, as compared with a ratio of 21·0 for the previous year. In other provinces an increase in the birth-rate has almost constantly been accompanied by an increase in the death-rate; but such has not been the case in the Madras Presidency during the year under report. The birth-rate has risen from a ratio, per thousand of population, of 24·6 in 1898 to 31·3 in 1899; and at the same time the death-rate has decreased from 21·0 in the former year to 20·1 in the latter. The following comment by the Sanitary Commissioner on the causes of the defective record of deaths seems to throw light on this failure of the death-rate to increase in unison with increase of the birth-rate. "One cause of deficient death-rate is certainly a tendency to ignore the deaths of infants below one year of age. This conclusion was forced upon me by the persual of numerous abstracts of village registers furnished to this Office by District Medical and Sanitary Officers during their inspections. It was obvious that the death of an infant who had not managed to struggle through a year of life was often held unworthy of official recognition, with the result of marring the total statistics supplied." Examining the table given in paragraph 18 of the Report, it is seen that the general infantile death-rate for the Presidency was only 159·0 per *mille* of births: in one district it is as low as 96·7. There can be no doubt that in the municipality of Madras itself the registration of vital statistics is effected with a nearer approach to accuracy than has been yet attained in any of the districts in the Presidency. The recorded death-rate amongst children under one year of age in the city of Madras for the year under report was 275·6 per 1,000 of births. As already noted, the general provincial death-rate recorded for children under one year of age was 159·0. These figures would appear to confirm the Sanitary Commissioner's conclusion that one cause of the lowness of the death-rate in the Presidency is failure to register the births of infants. The registration of births and deaths in the municipalities of the Presidency is acknowledged to be more accurate than their registration in rural circles. The birth-rate in the municipalities during the year under review rose from 34·9 in the former year to 37·0, or by 2·1: at the same time the death-rate fell from a ratio of 31·9 to a ratio of 30·7, or by 1·2. Seeing that the recorded death-rate of infants in municipalities was 233·9, it is evident that if the increase in the birth-rate had been great instead of, as it was, only inconsiderable, the death-rate would also have been proportionately higher. In Madras city itself, the vital statistics of which may be assumed to be the most accurate available in the Presidency, the birth-rate of the year under review was 40·4 as compared with 41·5 the previous year. Accompanying this decrease of the birth-rate the death-rate decreased from 45·2 to 38·5 per *mille* of population.

History of Chief Diseases.—The number of deaths from *cholera* was less than half that [illegible] the previous year, the death-rate falling to 0·9 from 2·0 per 1,000 of population. "As [illegible]inted out in former reports, the incidence of mortality was, as usual, in the south-west [illegible] districts greatest during the south-west monsoon, and, in the north-east monsoon districts, [illegible] north-east monsoon." The Sanitary Commissioner says that all the evidence received [illegible]es to point to the usually accepted fact that water contaminated with the specific germ is the [illegible]ethod of local propagation of the disease. Medical officers continue to report favourably upon [illegible]se of permanganate of potassium "in specifically contaminated water sources," but point out [illegible] this mode of disinfection often results in the use by the people of water from other sources. [illegible] definite statements can, under such circumstances, they admit, be made regarding the efficiency [illegible]ermanganate as a disinfectant.

. Small-pox mortality has again decreased. In 1897 the recorded death-rate from this disease [illegible]s 0·7 ; in the following year 0·6 : and now, in the year under report, 0.5 per 1,000 of population. [illegible]ccination made good progress, regaining much of the ground it had lost in the previous year, [illegible]owing to a scare consequent upon the people having hopelessly confused the operation of inoculation against plague with that against small-pox. An opinion existed, writes the Sanitary Commissioner, that plague was being spread among the people by inoculation under the guise of vaccination. This [illegible]are has fortunately subsided ; and although the number of successful primary vaccinations is still [illegible]ehind the number for 1897–98, it exceeds that of 1898–99 by 73,783 cases. The number of [illegible]e-vaccinations, on the other hand, shows a decrease of 15,692 cases. In the seven districts which [illegible]ecord a decrease in the amount of work during the year, this decrease is attributed in most of them [illegible]o absence of vaccinators from their posts, without substitutes having been appointed to take their [illegible]laces ; to continuance of the plague scare, and to the subsidence of small-pox disease. In both [illegible]rimary vaccination and re-vaccination the percentage of successful cases shows a substantial increase ; [illegible]n the former from 89·5 to 91·8, and in the latter from 75·4 to 76·1. The variations in the percentages of success in re-vaccination recorded in different provinces has often been noted : they are probably [illegible]hiefly due to differences of opinion as to the line which should separate successful cases from [illegible]ailures. In Germany, as we have noted in another *memorandum*, the percentage of success recorded in re-vaccination was 91·59 in the year 1898. A satisfactory feature of the season's work as compared with that of the previous year, is the marked increase in the number of young children vaccinated. The table given in paragraph 8 of the Vaccination Report, shows clearly the progress of infantile vaccination in rural and municipal Madras. In the districts, exclusive of municipalities, the proportion per cent. of the children born who were vaccinated was 25·8, in municipalities it was 79·2. In the large district of Malabar the percentage recorded was only 1·2. The results given by the different kinds of vaccine lymph used in primary vaccination during the year do not seem to differ greatly from those hitherto recorded. As usual, calf-to-arm vaccination has given the highest percentage of successful cases. Last year this percentage was 97·2, and in the present year 97·3. Next in efficiency comes calf lymph stored in glass without any admixture ; this gave a percentage of 95·7 successful cases. The efficiency of vaccine lymph thus preserved would ordinarily vary inversely with the length of time elapsing between the taking of the lymph from the calf and its subsequent use for vaccinating. After this, but at a long interval, follows lymph mixed with glycerine as a preservative. From the use of this paste a percentage of 88·9 successful cases is recorded. Last of all comes lanoline paste, with the slightly lower percentage of 88·4. The conclusion arrived at regarding the use of glycerine as a preservative of vaccine lymph is pretty much the same as that reached in some other provinces of India. The Inspector-General states "that glycerine paste gives results which approximate to those of animal lymph if used at once, or almost at once, but which are inferior in proportion to the amount of delay that may occur, and that it is therefore incapable of prolonged retention of activity—possibly a matter of minor importance in a temperate climate, but of special importance in the tropics." The results recorded by medical subordinates are at variance with those obtained by the vaccination establishment. In the hands of dispenary staffs and medical subordinates glycerine paste gave better results than lymph taken direct from the calf, the former giving a percentage of 84·1 as compared with only 77·9 given by the latter. Similar unexpected results obtained by the same class of operators were recorded in the previous year.

8. The mortality from *fever* was the lowest recorded since 1883. The death-rate from this cause was only 7·3 per 1,000 of the population. To the exceptional dryness of the year, and "to the not insignificant desire on the part of those registering deaths to escape the suspicion of a disease whose prominent symptom is fever, namely plague, rather than to drainage on a scale large enough to have much effect in reducing moisture in the soil, or the abundance of mosquito life thereupon depending," the Sanitary Commissioner attributes the diminished fever prevalence of the year.

9. The mortality from *diarrhœa* and *dysentery* was the same as during the previous year. Judging from the death-rates recorded in municipalities as compared with those in rural area, these diseases are vastly more fatal in the former than in the latter. In municipalities a death-rate of 4·3 per 1,000 of population is attributed to them, as against a rate of only 0·7 in rural areas. But registration of deaths is so much better carried out in the former than in the latter that it would hardly be safe to accept these figures as correctly representing the comparative fatality of these diseases in town and country.

10. The total attacks of *plague* in the Presidency during the year numbered 2,385 ; and of these 1,843 proved fatal. To some, these figures will doubtless appear insignificant in proportion to the excitement and anxiety caused by the disease, or the elaborate and costly measures taken with a view to staying its progress. But, looked at from another point of view, they may be taken as a proof of the success of those measures. The Sanitary Commissioner when describing the system of dealing with plague which has been followed in Madras, says, "the amount of success which has attended the endeavour suffices to prove its great utility, more especially when contrasted with the inconvenience and indifferent results in at least one other Presidency, by the adoption for a considerable

period of the principle of 'detention camps and quarantine.'" With the view of demand of certificated Sanitary Inspectors for plague duty, the Sanitary Commissione class of candidates for instruction in practical hygiene. "The endeavour was to train we men so as to be capable of recognising the disease, of taking necessary preliminary acti understanding the methods and reasons for disinfection." Nothing is more likely to conduc success of plague measures, some of them requiring delicate handling, than the provision of a well-educated, trained and tactful men to carry them into effect.

11. *Sanitary Works.*—In the year under report no sanitary work of great importance commenced in municipal towns. Funds that in ordinary times might have been expended on s works were held in hand to "meet the exigencies of a plague epidemic" with which public bo might at any moment have to cope. Statement No. XI. of the Appendix clearly shows the he task which most of the 60 municipal towns of the Presidency have to face before their drainage water supplies can be placed on a satisfactory footing. In one direction a distinct advance is be made. It is stated that 100 Certificated Sanitary Inspectors are now in the employ of 56 muni palities, and 15 in that of a few of the District Boards. The Sanitary Commissioner takes somewhat despondent view of rural sanitary progress. After remarking that, under presen circumstances, it may be a century before any sanitary improvement on a large scale in a single rura town is effected, he writes :—"In the course of my service I have known but two instances in whic a proposal—not ultimately put into effect—was made for radical improvement of the water supply drainage of a rural town. Yet there are no less than 92 towns having a population of 7,000 an upwards in this Presidency."

12. *Summary.*—The year was a healthy one. Until its last quarter food was cheaper than in th two preceding years. It was not until the autumn rains failed, and a recurrence of scarcity wa anticipated, that prices rose. The birth-rate was the highest hitherto recorded in the Presidency This is shown to have been partly due to better registration, to increased population since last census. and to return of prosperity in succession to a season of distress. The death-rate was below that o the previous year. Registration of vital statistics is receiving ever increasing attention, but is st very defective. From cholera, small-pox, and fever there were fewer deaths than in 1898. Vaccination regained much of the ground it had lost owing to the plague-inoculation scare which had prevailed during the preceding year; but the numbers vaccinated were still below those of 1897–98. Lymph used direct from calf to arm gave the best results, and calf lymph mixed with lanoline the worst. The exceptional dryness of the year doubtless contributed to the comparative immunity of the population from malarial fevers. The deaths due to this cause were the fewest recorded since 1883. The measures adopted with the view of staying the spread of plague were, judging from results, attended with success. The need for husbanding their resources to resist possible plague invasion, prevented municipalities from embarking on new and expensive works of sanitary improvement.

14th May, 1901.

No. 11.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1899.

The most striking climatic feature of the year was failure of the rainfall. This led to a recommencement of the famine conditions of 1896-97, from the effects of which the Presidency had only just had time to recover. To famine was added plague, and to these combined may largely be attributed the greater unhealthiness of the year as compared with its predecessor. Some idea may be gathered of the completeness of the rain failure from an examination of the returns given on pages 28-34 of the Report. Taking a few of the collectorates as examples it will be seen that in Khandeish only 8·54 inches of rain were recorded against an average of 42·78; of 6·5 in Kaira against 37·48, and of only 4·72 in Ahmedabad against an average of 32·29. In parts of the country, so entirely deprived of their annual complement of rain necessary for the cultivation of the soil and the growth of crops, the consequences to man and beast could not be other than disastrous. Not only grain crops and fodder, but vegetation generally would wither up, and even a sufficiency of drinking water to sustain life would be wanting owing to non-replenishment of the usual sources of supply. In September, when all hope of rain had gone, prices rose to a great height. The two millets, *jowari* and *bajri*, the staple food grains of the people, more than doubled in price. Wheat, which is too expensive a grain to be ordinarily used by the common people, also increased greatly in price, although not to so ruinous a degree as the millets. Second quality rice varied considerably in price in the course of the year, but with a markedly upward tendency. It was not until towards the end of the year that the people began to experience the full force of these calamitous conditions, and their effects will probably, therefore, be more deeply stamped on the vital statistics of the following year than on those of the year under report.

2. The small European and Eurasian populations, numbering 18,486 of the former and 8,519 of the latter, return abnormally low birth and death-rates. The recorded birth-rate amongst the former was only 11·96 and the death-rate 12·52; whilst amongst Eurasians the figures were 19·49 and 21·72. Compared with the rates recorded in the preceding year, those for Europeans show a slight decre in the case of both births and deaths, whilst those for Eurasians show a considerable increas

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